MONTHLY JOURNAL DEVOTED TO THE DEVELOPMENT OF FISHERY INDUSTRIES

ISSN - 0971 - 452

FISHING CHIMES

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Indian Shrimp Aquaculture:Overview

Special Fish Farmers' Day

Asia-Pacific Fishing Conference

SEPTEMBER 2001

ol.21 No.6 National Fisheries Journal of India:Estd 1981 Rs 65

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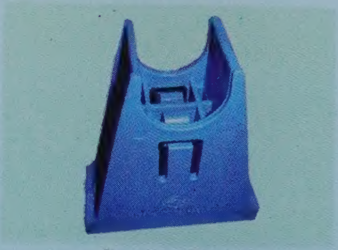

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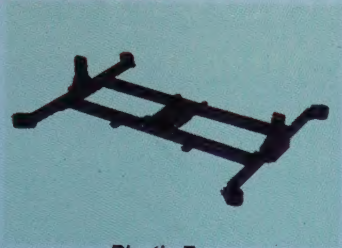

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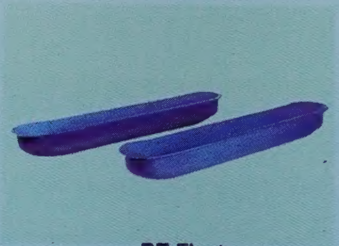

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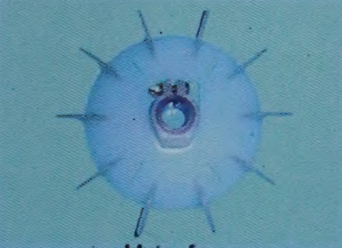

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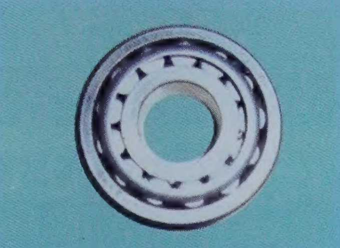

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NATIONAL FISHERIES JOURNAL OF INDIA

Vol.21 No.6
SEPTEMBER 2001

CONTENTS

Special Fish Farmers' Day

It was on 10 July 1957 major carps were successfully induced to breed at Angul in Orissa. This was the outcome of the sustained efforts of the veteran fisheries scientist Dr. Hiralal Chaudhuri. Recognising the significance of the event and its impact which led to the remarkable growth of inland culture fish production of India over the past four decades and raised the stature of india to a second position among various nations in global inland fishery output, next only to China, Government of India declared 10 July to be observed annually as 'Special Fish Farmers' Day. This recognition is not only to commemorate the day but also to motivate the farmers to have an annual get-together on that day to review their achievements and identify their future needs to be brought to the notice of the Government..9

Status of Indian Shrimp Aquaculture : An Overview

Shrimp aquaculture in India has taken a sustainable shape in recent years, and it has come to be a major culture activity with potential for augmenting aqua exports and raising the socio-economic status of aqua farmers. Cultured shrimp production in India zoomed up to an annual level close to 100,000 t, supported by a shrimp PL production capacity of 10,700 million lakh nos from 222 hatcheries located all along the coastline, with most of them on the east coast. Further, the emergence and expansion of shrimp culture activity in freshwater ponds which has been a recent development, has opened up new opportunities. An overview 27

Reflections on Certain Possible Gaps in Indian Shrimp Culture Practices

K.R. Prasad highlights in this contribution a few conspicuous innovations in shrimp culture, such as, 'Aqua Mats', pond lining system, Activated Suspension Pond system, and closed recirculation system, successfully and profitably adopted in US and in some Central American countries and others with sustainability and environment - friendliness. He wonders whether introduction of these innovations in Indian shrimp culture systems would improve quantitative and qualitative production of cultured shrimp in India. In this contribution, he has relied upon the published material in *Global Aquaculture Advocate*, USA, published by Global Aquaculture Alliance 33

Third Asia - Pacific Fishing/Ausmarine East Conference

This Conference, organised by Baird Publications and held in Cairns, Australia, turned out to be a well-participated event, putting in focus several outstanding marine fishery-related issues confronting the region. A wide range of products were displayed at the various stalls set up at the impressive Exhibition that was part of the event. The stall of Garware wall-ropes, among others, attracted considerable attention of the visitors. Several papers were presented at the technical sessions, of which three were by Indian authors and one each by a Srilankan and Thai author. Mr. Richard Mounsey made a candid presentation on the fishing situation in East Timor waters. Bundit Chokesanguan of SEAFDEC, in his presentation, appealed for sustainable development of fisheries of the Asia-Pacific through a Regional Code of Conduct for Responsible Fisheries 69

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And a collection of new items

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Editor & Publisher
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Website
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Printed by:
G.Ramakrishna
Raamakrishna Printers Ltd.,
49-24-5, Sankaramatham Road
Madhuranagar, Visakhapatnam - 16
Tel : (0891) 798072

Registered as a journal of India (No.37750/81)

Resident Editors

Vijai Dev Singh
A2/91, Paschim Vihar, New Delhi - 63

H.S. Bandapanda
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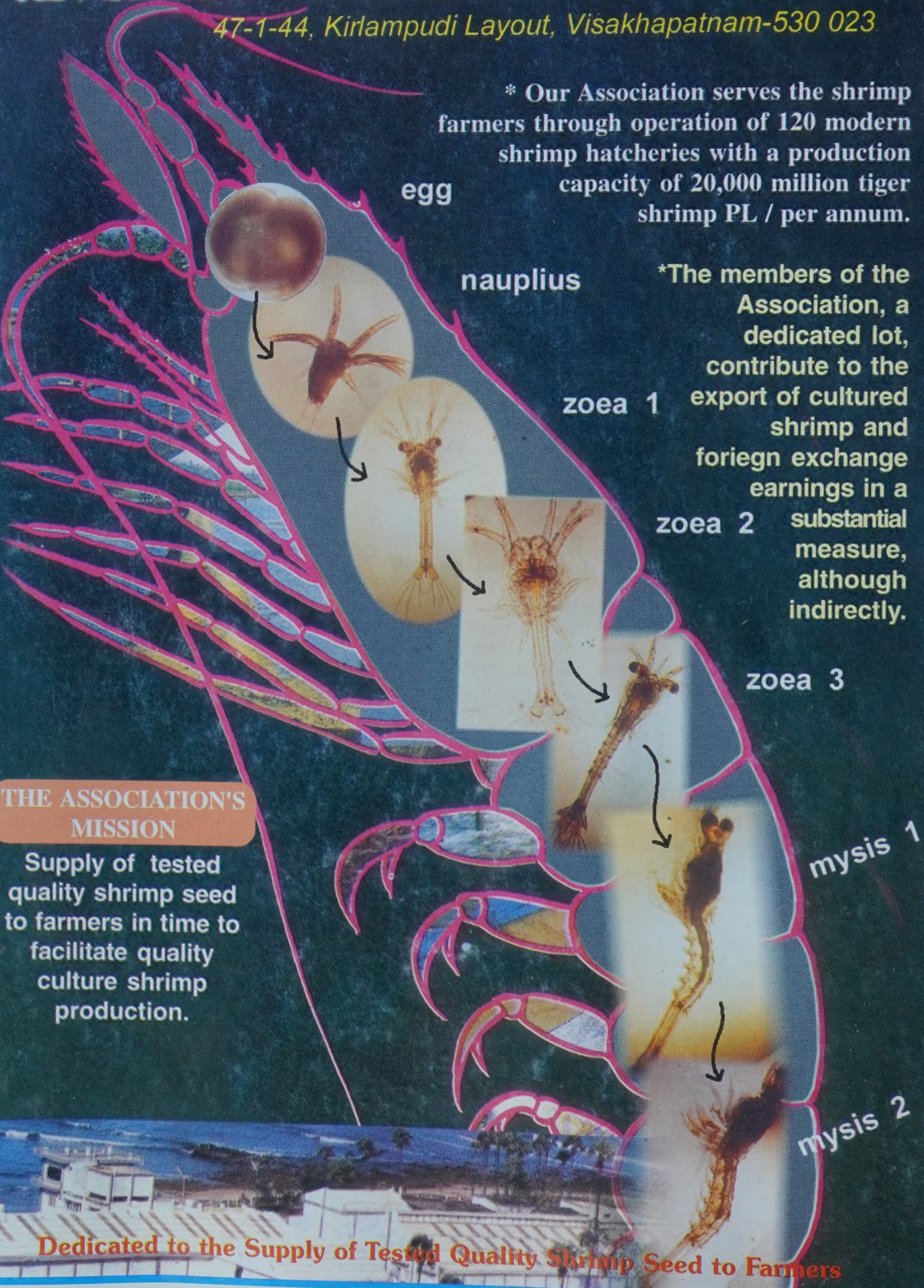

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...... On Generation of National Fisheries Policies

The shape of emerging needs and the positive compulsions that they generate generally excercise a profound influence on the government concerned in the formulation of policies in respect of developing sectors such as fisheries. Traditionally the primary function of any democratically elected government is to take care of the welfare of the people on one hand and maintain law and order on the other. In respect of discharging these responsibilities governments have the support of a well established mechanism that provides information on conditions of existence for instituting such measures as are necessary to discharge the related responsibilities.

Fisheries Developmental activities are relatively less traditional in nature, with just around 50 years of accumulated experience in the country. While governments have departments to promote and monitor these developmental activities, the source that generally provides motivation for initiating a developmental work are the people. Politicians are of course the chiefs that run governments and in this process they reach out to be in touch with the pulse of the people, engaged in various commercially oriented developmental sectors for giving shape to policies thereof. They know that this approach is basic for the purpose. Those engaged in the various commercially oriented developmental sectors are aware that their prosperity depends on the understanding of their requirements by the government concerned and the policies adopted by them . In this context those engaged in the sector form into Associations/Federations to represent their needs to the governments concerned. There is thus a mutual dependence, those in industry (commercially oriented development sector) telling the government concerned through their Associations what they want, and industry telling about their problems to the government concerned for formulating policies on that basis. Any disbalance in the equilibrium will result in an ill-fated developmental trend.

In the same way as in any developing industry, in the fisheries industries too, upgradation or expansion is a continuing process. Solution to one problem often leads to the emergence of another problem. In other words, the developmental process unleashes a string of situations that call for total alertness on the part of the Associations to project the problems faced and the policy measures needed to get over them for the attention of the government concerned.

In this background, it is axiomatic that all fisheries associations must maintain a continuing and dedicated interface with the authorities concerned regarding the issues facing the industry and the policy options to be excercised. Such continuous contacts will promote a healthy relationship with a perspective between the government and the Association concerned. Unfortunately most of the fisheries associations are deficient in adopting this approach. They ignore the need for timely representations to the government concerned on vital aspects.

As mentioned already, it is the politician who has his finger on the pulse of those engaged in the fisheries industries (in the same way as in the case of other industries), and the ministers in charge of fisheries happen to be politicians. Once policy matters based on representations made by the fishery industries are brought to their notice, they respond far more incisively than others. They evaluate the ground situation and pronounce policy and strategy directives.

Thus the process of policy or strategy formulation generally takes off from the level of Associations. The need is therefore for the various Associations to strengthen themselves in the right direction, to function confidently and effectively in their relationship with the senior functionaries and the ministers in the government concerned. They must identify and nominate such of the members who are knowledgeable and talented as their emissaries and spokesmen and lend all needed support to them so as to enable them to articulate the points of view of the Association concerned before the authorities effectively. The general pattern to emerge has to be such that they should be having meetings with the authorities as frequently as possible and be a known sight in the corridors of Krishi Bhavan or in other power-centred Bhavans, carrying the message from the industry to the authorities concerned. Unless a culture of this kind, purposeful and devoted and imbued with an equation is developed, there will be bleak chances of emergence of policy and strategy decisions from the government concerned as the related fishery industry needs. At present there seems to be a ridiculous situation of some of the Associations not being quite sure of what kind of policies they want and what policies to be continued. For example, the Association of Indian Fishery Industries want a deep sea fishing policy to be announced by the government but one

☞

hopes that it would be able tell the government what kind of policy it wants beyond reference to what Murari Committee recommended. The impulse is to suggest banning of import of Thai and Taiwanese vessels, on the premise that they continue to be really owned by enterprises of those countries with the total crew comprising their nationals and using the Indian flag as flag of convenience just for gaining entry into Indian EEZ. It is to be hoped that it will propose a well argued alternate policy option. In fact, the Association appears to need to develop a system of meeting the concerned in the government and make representations on vital issues confronting the industry from time to time. True, it sends letters to government on the needs of the industry from time to time but these would not have the impact of personal representation of policy needs comprehensively.

Governments cannot normally be expected to take the initiative and responsibility for launching important fisheries policies unilaterally without taking the industry into confidence. In fact, governments long to receive representations from the industry/its associations from time to time oriented towards augmenting fish production and on various post-harvest aspects in a sustainable and eco-friendly manner through removal of hurdles in the way.

There are however some organisations that are active. The National Fish Workers' Forum and a few state-oriented Associations are seen to be active in demanding certain policy interventions by the government fairly effectively. So is the case with the Seafood Exporters' Association of India. It has a network of state-wise centres that project their problems to enable the main association to take them up with the Centre for policy decisions. Thus, so far as seafood industry is concerned, government gets the needed feedback from it and the industry receives policy support as justified, from the government. In the case of culture sector and capture fishery sector the position is however not however that bright.

Marine capture fishery stocks, by and large, are now at a critical point of exploitation and the problem faced is largely one of regulation and conservation of the resources of coastal zone on one hand and exploitation of coastal pelagic and high sea pelagic resources and demersal resources of the deepsea of the Indian EEZ. In the present situation of stagnation in marine fish landings from Indian EEZ by Indian fleet, and lack of fishing fleet equipped to catch tuna, the main resource that is available for stepping up exploitation in the zone, the potential future developmental prospects of the Indian fishery sector are predominantly intertwined with the growth of the three-pronged culture fishery segment, consisting of freshwater, brackishwater and seawater lentic units.

The farmers do have their Associations mostly at district levels. The Aquaculture Foundation of India continues in its endeavours to have effective linkages at district and state levels but this situation has not enabled it to emerge as a strong force to counteract the strategies and activities of the environmental lobbies (believed by many to be misplaced) effectively for the benefit of the farmers.

Several innovative technologies that would totally make aquaculture environmentally safe are now available but not much could be done to prevail upon the government to evolve policies for the popularisation of these technologies (closed recirculation systems, zero-water exchange, pondlining, non-polluting feeding systems etc.). The lack of strong leadership among farmers has become a major handicap in that no effective representations related to policy matters reach the state government concerned and the central government. Shrimp hatchery owners have Associations, may be in a couple of states, and they have the good luck of having the positive support of MPEDA, mainly for the reason that, shrimp exports can go up only when the hatcheries function well and supply seed to farmers. Despite this advantage, the Hatchery Associations have not taken up issues such as development of domesticated brood shrimp stocks for production of PLs at the hatcheries. The hatchery owners seem to be reconciled to courting the wrath of the government and others for being responsible for overfishing of wild broodstocks. If these Associations are strong they could have certainly taken up the issue strongly with the government concerned and obtained helpful policy decisions in respect of domesticated broodstock development. As the present aquaculturists lobby is mostly district-oriented and weak, no policy formulations are taking place in respect of viable and sustainable activities such as sea cage culture and other types of mariculture which involve legal support in respect of leases of seawater areas etc. The recent initiatives of the government on its own in respect of utilisation of waste saline lands for aquaculture, development of reservoir fisheries etc., should put the private enterprises of fishery sector to shame, as these initiatives should have come first from the farmers and entrepreneurs.

In sum, what is sought to be highlighted is that strong, well informed and widely representative National level fisheries apex bodies with supporting organisations at State and District levels should emerge to strengthen the hands of the central and state governments to take sound and development-oriented policy decisions for the effective and sustainable utilisation of fisheries of the country. As long as this does not happen, the state of fishery development of India will continue to vacillate between stagnation and slow growth. It also appears necessary for the Central Institute of Fisheries Education to conduct well designed courses periodically based on a well drawn syllabus, for the benefit of the nominated office-bearers/members of the Associations to enable them to develop a wider perspective of the subject and to educate them on policy aspects and as to the form in which to represent their problems to the government concerned to enable them to evolve suitable policies and strategies for their implementation.

Nation-wide celebrations......
Special Fish Farmers' Day
10 July 2001

Tenth July 1957. A great day that lives in legend and song of inland culture fishery sector of India, for, on this day, a momentous event took place.

Dignitaries on the dais: **L to R ~ Dr. K. Gopakumar, Dr. Anand Rao Devkate, Mr. Nitish Kumar, Ms. Meenakshitai Patel, and Ms. Nita Chowdhury**

Mr. Nitish Kumar, Union Minister for Agriculture lighting the inaugural lamp

Dr. P. V. Dehadrai (Centre), presiding over Technical Session. To his left is Mr. J.S. Sisodia and to his right is Mr. J.V.H. Dixitulu

Fisherwomen of Versova village felicitating Mr. Nitish Kumar, Mr. Anand Rao Devkate, Ms. Meenakshitai Patel

This event was the glorious success achieved by Prof.(Dr.) Hiralal Chaudhuri, Fishery Scientist of CICFRI at that time, in inducing major carps to breed through administration of homogenised harmone extract of fish pituitary into their body intravenously. This technology spread among fish farmers swiftly, thereby enabling the substitution of river carp spawn / fry collection practised by them with this technology, which enabled them to produce seed of major carp species they wanted to culture, in numbers as they wanted, under controlled conditions. The achievement of Prof. Chaudhuri has rid them of the wearisome job of segregating quality seed fit for stocking in ponds from wild collections. The quantity of culture fish production cascaded over years to an enviable peak which has elevated India to an exalted status of being No.2 in global culture fish production, next only to China. The upsurge in culture production has enhanced the per capita consumption of fish from an insignificant level in 1957 to an estimated 9 kg. per annum as at present. This remarkable development is the result of the devoted contribution made by a large number of aquaculturists.

Dr. S. Ayyappan welcoming the participants

The emergence of Fish Farmers Development Agencies in 1970s has further fostered the production of major carp seed through induced breeding and adop

A view of some of the participants

Mr. Nitish Kumar handing over the Citation to Mr. Ch. Srikanth, after conferring upon him Hiralal Chaudhuri Best Fish Farm Gold Medal of Fishing Chimes Jayasree Charitable Trust

Mr. Ch. Srikanth and his family members in a group photo with dignitaries after the Award

Dr. S. Ayyapan, Vice-Chancellor / Director, CIFE felicitating Fisheries Minister of Maharashtra, Ms. Meenakshitai Patel

Mr. Nitish Kumar delivering inaugural address

Mr. S.C. Mukherjee, Joint Director, CIFE, proposing vote of thanks

tion of circular hatchery system. The net result of this has been the steady supply of major carp seed to meet the needs of farmers, generation of higher incomes to fish farmers and an annual contribution of 2.6 million t. of fish almost equal to the annual marine fish production. A decade back no one could have even imagined that inland fish production could grow so much to be at par with marine fish production.

As a tribute to the significant contributions made by the fish farmers to the growth of culture fish production, which originated from the pioneering work of Hiralal Chaudhuri, the fisheries division of the Department of Animal Husbandry and Dairying, Government of India has declared a "Special Fish Farmers' Day" to be observed on 10th July every year.

First Special Fish Farmers' Day

Accordingly, the first Special Farmer's day was celebrated in the various States of the country on 10 July, 2001.

The tone of the celebrations was set at an auspicious function held at the Central Institute of Fisheries Education, Mumbai on that day. This function was inaugurated by Mr. Nitish Kumar, Union Minister for Agriculture at that time. It was thronged by a large number of fish farmers, fishers and several dignataries. Mr. Anand Rao Devkate, Minister for Fisheries and Ms. Meenakshitai Patel, State Minister for Fisheries,Govt. of Maharashtra, graced the occasion. Among the other prominent participants were Ms. Nita Chowdhury, Union Joint Secretary (Fisheries), Dr.K.Gopa Kumar, Deputy Director General (Fisheries), ICAR, Dr.S.A.H. Abidi, Member, Agricultural Scientists' Recruitment Board, Dr.S.Ayyappan, Director and Vice Chancellor, Central Institute of Fisheries Education, Mumbai, Mr. J.S. Sisodia, Deputy Commissioner (Fisheries), DAHD, Delhi Dr.S.D.Tripathi, former Director of CIFE, Dr.PV.Dehadrai, Rtd. Dy.Director General (Fisheries) ICAR, Mr. M.B. Appalwar, Commissioner of Fisheries, Maharashtra and many others.

Welcome Address

Dr.S.Ayyappan warmly welcomed Mr.Nitish Kumar, Mr.Ananda Rao Devkate, Ms.Meenakshitai Patel, Ms. Nita Chowdhury, Dr.K.Gopakumar, the participating farmers and fishers, and other distinguished participants. He said that it was the fortune of the Central Institution of Fisheries Education to have become the main venue for the inauguration of the historic event by the Union Agriculture Minister and this event would live in the annals of the Institute.

Nita Chowdhury's Address

Ms.Nita Chowdhury conveyed the gratitude of the fish farming community to the Government of India for recognising the importance of 10 July, the day on which induced breeding of major carps was first achieved by Prof. Hiralal Chaudhuri, and declaring the day as "Special Fish Farmers' Day". It was pointed out that this declaration put in focus and highlighted the importance of the day. She said that it was a great step forward and that this day would gain in strength year by year as a platform for the farmers/fishers to participate and discuss with pride their problems and achievements and to place before the Government the kind of further support they would require to take culture fish production to newer heights. Pointing out that the observance of the Day was the pride of the country, she exhorted the participants to pledge and dedicate themselves for the upliftment of fish farmers and fishermen to a higher level of economic prosperity. She paid a particular tribute to Prof. Hiralal Chaudhuri for his achievement which had impacted in such a prominent manner as to step up culture fish production of the country in an unparalled manner.

Pointing out that, while India was now in the second position globally in regard to the inland fish production, she reminded the participants that there was still a major gap between the production levels achieved by China, now in top position, and India. While the Chinese annual inland production was 21 million t., the annual Indian Inland production, although well augmented, was still at 2.4 million t level. She hoped that the farmers would put forth their best to step up culture fish production so that the gap would get narrowed down substantially and eventually surpass Chinese producion level.

Speaking on women's role in the fisheries sector, she said that 70% of fish vendors of the country were women, and that women were playing an increasingly active role in post-harvest operations.

Strides in Haryana and Punjab

She made a pointed reference to the amazingly upward strides being made in culture fishery sector in Haryana and Punjab for the past few years. In these two States the annual cultured fish production, achieved by enterprising fish farmers, had reached a level of the order of 5.0 t/ha/annum compared to the National average of around 2.3 t./ha/annum, she pointed out.

Gopakumar's Address: Farming Problems Intricate

Dr. K.Gopakumar, referred to the range of annual cultured fish production achieved in the various States. While the annual production in Gujarat stood at 1.2 t./ha, it was at the level of 5 t/ha in Punjab. The present need was for the various State Govermments and the farming community to institute all needed steps not only to bridge this gap but also to step up the present annual production per ha to a higher level. The day when this could be achieved would be another memorable Special Day in the annals of Indian fish culture sector. He said that the issues confronting the fish farming sector were intricate and these would have to be resolved in an enduring manner to enable this sector to emerge stronger.

Mr.Anandarao Devkate, Minister of Fisheries and Ms. Meenakshitai Patel, State Minister of Fisheries, Government of Maharashtra spoke on the importance and significance of the Special Fish Farmers' Day which the Government of India so thoughtfully declared. They said that the beneficial impact of the celebrations would be felt all over the country.

Inaugural Address

Mr. Nitish Kumar, in his inaugural speech paid a rich tribute to Prof.(Dr.) Hiralal Chaudhuri. He described him as a dedicated fishery scientist who ushered in blue revolution in the inland culture sector by gifting to the fish farmers of the nation the induced fish breeding technology. This single event had showered immense benefits among fish farmers and had imparted a new pride to the nation, he added. It was mentioned by him that the declaration of Special Fish Farmers' Day was the result of the approval accorded by the Prime Minister himself, based on the proposal worked out by Ms. Nita Chowdhury. He lauded the efforts of Fishing Chimes Jayashree Charitable Trust which had instituted Hiralal Chaudhuri Best Fish Farmers' Gold Medal Award and expressed his happiness that this Award for the year 2001 would be conferred on the present occasion on Ch.Srikanth, a progressive and distinguished fish farmer, hailing from Nellore district of Andhra Pradesh. He had congratulated Ms.Nita Chowdhury, for successfully steering the fisheries development of the country with dedication and devotion, as Joint Secretary (Fisheries) in charge of the subject.

Micro-management Schemes: The Minister assured the participants that the restrictions and controls or relaxations that were introduced because of W.T.O would have no adverse impact on fishing and fish business. He also expressed the view that the economics of commercial activities of fisheries sector would have to improve considerably to facilitate reduction of subsidies, presently applicable to the sector, by the government. It was mentioned by him that the Savings-cum-Relief Schemes now in vogue in the sector were applicable both to fishermen and fisherwomen. The same was the case in respect of Insurance and Housing Schemes, he added. The Minister laid emphasis on the adoption of micro-management schemes under which 90% of outlays could be provided by the Centre and 10% only contributed by the State governments.

***Union Fisheries Department must be set up*: The Minister revealed that he advised his officers to come up with a proposal for reforming fisheries development system of the country at Central level by bringing together the various segments of fisheries now being dealt with by various ministries, and achieve their integration under the fold of a separate Union Department of Fisheries by upgrading the present Fisheries Division under the Department of Animal husbandry. He said that the need for such an integrated approach was long over due. It was unfortunate that the immense potential of fishery sector, which presently fetched a whooping Rs.6,000 crores foreign exchange annually, was virtually underplayed, by leaving it to be developed a Division in the Ministry ofAgriculture, he commented.**

All Schemes to be of a single category: He favoured the abolition of the present categorisation of schemes as Central and Centrally sponsored schemes and in their place have one amalgamated category. The outlays related to the schemes could be shared by the Centre and the State concerned on mutually agreed formulae.

Aquaculture Authority to be Statutory: The Minister made a reference to the Aquaculture Authority Bill proposed for introduction in the parliament. He said that the report of the Standing Committee on the subject was received and was being taken into account for finalising the draft bill. He affirmed the resolve of the government to replace the present Authority with a statutory one.

Ornamental Fishes: The Minister told the participants that the proposal for providing a subsidy of 35p on every litre of diesel oil consumed by fishing vessels was now under consideration of the Prime Minister. He pleaded that the industry should take special interest in respect of production of ornamental fishes, particularly for exports.

Promote Hilsa Culture: He exhorted the fisheries scientists to conduct detailed studies and evolve needed measures for promoting production of Hilsa which was showing trends of depletion. He expressed the view that it should be possible for the scientists to standardise an economically viable technology for hilsa culture and popularise the same among farmers.

Promotion of Integrated Fish Farming: The Minister pleaded for fresh initiatives to promote integrated farming, with fish culture as a major part of it. This was necessary to ensure economic utilisation of various inputs to avoid conflicts between agriculturists and the fish farming class. He added that the Central Rice Researh Institute had done considerable work on integrated farming, covering fish culture too. He laid emphasis on this approach for the particular reason that there was no way of increasing land under agriculture further and therefore the alternative was to concentrate on utilisation of water resources for fish production.

Concluding, the Minister expressed his firm belief that development of fisheries had a great role to play in augmenting proteinacious food production for the benefit of the common man and also for exports. Re-emphasising that the subject of fisheries needed greater focus, he reiterated the urgent need to set up a separate union fisheries department for augmenting fish production as a way of increasing incomes of those at grass root level of the sector and for augmenting aqua production and exports. The nation had the technology for producing pearls and this had to be extended to the private sector. Pearls were now being imported and the quantum of imports had to be brought down through our own production.

Hiralal Chaudhuri Gold Medal Conferred: The conferring of Hiralal Chaudhuri Gold Medal 2001 of Fishing Chimes Jayashree Charitable Trust, along with a Citation, on Mr. Chi.Srikanth by Mr. Nitish Kumar followed, amidst applause and ovation. The Citation was read by Mr. J.V.H.Dixitulu, Chairman of the Trust. It read as follows:

CITATION

"Sri Chadalawada Srikanth *of Maharaja Hatcheries, Nellore, Andhra Pradesh, is an outstanding fishery professional among fish farmers. He started his career as a humble farmer in early 1980s, when he developed carp farms in his inherited agricultural land at Padappai, Tamil Nadu. He produced as much as five tonnes of Indian and exotic carps per hectare per year in his farm at Padappai, at a time when commercial carp aquaculture in Tamil Nadu was receiving the least priority. Benefitting from the rich experiences from carp culture, and realizing the scarcity of the supply of carp seed, he shifted his attention to carp seed production, and made great strides in mass production of carp seed which stood the mainstay for popularizing carp production in the southern states of India. He also started a Chinese hatchery in Padappai.*

Sri Ch.Sri Kanth's latest interest in scampi *culture (Giant freshwater prawn,* ***Macrobrachium rosenbergii****) is the most notable of all his contributions. He realized the rich potential of scampi farming in his home state, Andhra Pradesh, much ahead of others and devoted his attention to the seed production of scampi when the technology was still at* *an infant stage. He learnt from initial failures and was successful in establishing commercial scampi hatcheries in Chennai in Tamil Nadu and Nellore in Andhra Pradesh. He now manages to produce and supply the highest quality of scampi seed from three of the hatcheries in Nellore run by him and his partners, and also supply from three hatcheries in Chennai run by his brother-in-law, Sri G.S.Samarsam and his family members. Quality has always been the key to his success. Apart from seed production, he is also in the forefront of technical assistance to about 5,000 hectares of farming areas in various parts of Andhra Pradesh. He is instrumental to the prosperous development of scampi culture in the whole of Andhra Pradesh, the state that now boasts of about 50,000 ha of scampi farming area.*

Though satisfied with this progress, Sri Ch. SriKanth feels that there is still lot of scope for improvement in scampi culture in the country. He is always a farmer at the core of his heart, and is ever willing to undertake any challenge, or help anybody to develop scampi farming in India. He is now keen to develop scampi culture in states like Haryana, Madhya Pradesh and so on. At this early age, he is as vibrant as ever and has a great vision for future far beyond many others in his field.

May the Almighty bless Sri Ch.SriKanth and family with a long life and many more years of devoted service to the aquaculture sector and the country."

Mementos were presented to the Maharashtra fisheries ministers and to several distinguished guests and Certificates of merit and mementos were also presented to several fisher leaders.

Dr. S.C. Mukherjee, Joint Director, CIFA, proposed a vote of thanks.

Technical Session

A technical session was later held under the chairmanship of Dr. P.V. Dehadrai. There was an active interaction between the scientists and farmers/ fishers at the session.

MAHARASHTRA

The Department of Fisheries, Maharashtra, celebrated the Special Fish Farmer's Day at Yashwantrao Chavan Pratishthan Auditorium in Mumbai. The deliberations focused attention on the contribution made by the aquaculture sector to the national economy. The Day was also celebrated in various districts of Maharashtra. Workshops, seminars and exhibitions were conducted on induced fish breeding and aquaculture with the active participation of fish farmers at various district centres. The deliberations provided guidance to fish farmers and encouraged them to reach new heights of endeavour in their profession.

The Special Day function held in Mumbai was chaired by State Fisheries Minister Mr. Anandraoji Devkate and participated by Ms. Nita Chowdhury, Joint Secretary,(Fisheries), Govt. of India, and Dr.V. Somvanshi, Director General, Fishery Survey of India. Officers of the State Fisheries Department, fishery enterpreneurs, fish farmers and several others connected with fishing industry enthusiastically took part in the function.

Mr. M.B.Appalwar, Commissioner of Fisheries, Maharashtra, welcoming the participants, recalled the major achievements of Maharashtra State in fisheries sector, and pointed out that major carps were successfully induced to breed in the State for the first time in the year 1967. Ms. Nita Chowdhury, offering felicitations, assured that all assistance would be extended by the Centre for the development of fisheries of Maharashtra State. Dr. Somvanshi, Director General, Fishery Survey of India, referred to the significant contributions made by the fish farmers of Maharashtra. Mr. Tandel, Vice Chairman of Maharashtra Fisheries Development Corporation suggested to the authorities to take all needed steps to ensure that fish farmers secured viable returns for their produce and that they were not exploited by middlemen.

Several persons who had contributed to development of fish farming were felicitated by presentations of 'shawl and shrifal' by the Fisheries Minister Mr. Anandraoji Devkate and Ms. Nita Chowdhury, Union Joint Secretary (Fisheries). The recipients of the honour were Messers Damodar Tandel, Chairman, Sagarputra Fisheries Cooperative Society and Vice Chairman of Maharashtra Fisheries Development Corporation, Mumbai, Dilip Pagdhare, Chairman, Mahim Fisheries Cooperative Society, Keshv Koli, Chairman, Sassoon Dock Fisheries Cooperative Society, Rambhau Patil, Chairman, National fishermen's Forum, Vijay Bandarkar, Vice-Chairman, Maharashtra Rajya Machhimar Kriti Samiti, Ramji Nakhwa, Chairman, Martand Fisheries Coop. Society, and Dr. K.A.Dongre, the senior most Deputy Director of Fisheries in the state department of fisheries, who had contributed enormously for the fisheries development of Maharashtra.

The Fisheries Minister assured the fish farmers that all efforts would be made for solving their problems in respect of receiving supplies of seed, feed and those related to marketing of their produce, etc.

Mr. Subhash Meshram, Regional Deputy Director of Fisheries, Mumbai, proposed a vote of thanks to the participants.

WEST BENGAL

The State Government, the State Fisheries Department, Fishermen's Coperative Societies and the fish farmers of West Bengal welcomed the declaration of 10 July by Government of India as Special Fish Farmers' Day. It was mentioned that the State Fisheries Department (now renamed as 'Fisheries, Aquaculture, Aquatic Resources and Fishing Harbours Department') of the Government of West Bengal had long been pursuing with the Government of India for extending due recognition to the services rendered by fish farmers in augmenting fish production. In this context, there was a general expression of happiness that the Government of India had declared 10th July as Special Fish Farmers' Day. ☞

The Day was celebrated at the auditorium of the newly built Benfish Bhavan (an Apex body of Fishermen's Cooperative Societies, West Bengal) located at Salt Lake, Sector V, Kolkata. The function was attended by several scientists, fishery technologists, fish farmers, Members of Fishermen's Cooperative Societies, Fishery Officers, Faculty Members of Fishery College and of Universities of the State and several fishery students. There were altogether 450 participants and the auditorium overflowed with them.

Dr. Hiralal Chaudhuri, who gave to the Nation the induced fish breeding technology, was the Chief Guest. The other honoured guests were Dr. B.C.Sarma, Ex.Fisheries Secretary, Govt. of West Bengal and Ex.Joint Secretary, (Fisheries), Government of India, Dr.A.K.Ghosh, Director, CICFRI; Dr.P.Das, Ex.Director, N.B.F.G.R. and Mr.Nilratan Ghosh, renowned progressive fish farmer and the recipient of Dr.Hiralal Chaudhuri Gold Medal Award, 2000, instituted by Fishing Chimes Jaysree Charitable Trust, Visakhapatnam.

Mr. Kironmoy Nanda, Minister for Fisheries, Government of West Bengal, presided over the function which started with an invocation folk song by a group of fishermen from Nadia district.

Mr. Naresh Chaturvedi, Principal Secretary, Department of Fisheries, Govt. of West Bengal, extended a warm welcome to all the participants, particularly to Dr.Hiralal Chaudhuri. In his speech which was listened to with rapt attention, Dr.Hiralal Chaudhuri, recalled the moments of excitement that overtook him on 10 July 1957, the day on which he could, for the first time, successfully induce major carps to breed, overcoming several odds. In this context, he acknowledged the encouragement and cooperation extended by Dr.G.N.Mitra, who was the Director of Fisheries, Orissa, at that time. Mitra provided all needed infrastructural facilities but for which he would not have been able to succeed, he added.

Mr.Kironmoy Nanda presented a silver plate inscribed with a citation to Dr. Hiralal Chaudhuri, along with a ceremonial shawl and a flower bouquet with fortyfour specially decorated red roses, symbolizing the 44th year of his success and in recognition of his epoch-making contribution. The auditorium reverberated with spontaneous ovation accompanied by rythmic claps. The citation was read by Mr.D.P.Banerjee, Special Secretary, Govt. of West Bengal.

Dr.A.K.Ghosh, Director, CICFRI, felicitated Dr.Chaudhuri, on behalf of his Institute with a shawl and bouquet.

Mr. Kironmoy Nanda conferred the Productivity Awards 2001, introduced for the first time in the State, on Mr. Shrikanta Midya, an FFDA farmer, belonging to Mahespur village of Howrah district, and on the Secretary of Bonhoogly Fishermen's Cooperative Society Ltd., Bonhoogly, Kolkata-700035, for their achievements in producing 8.4 mt/ha/yr and 9.3 mt/ha/yr of fish respectively.

Mr. Nilratan Ghosh, spoke on the occasion. He highlighted the importance of quality control in eco-hatcheries in respect of brooders and cautioned against indiscriminate hybrid formation. He emphasised the imperative need for resorting to the judicious use of brooders collected from wild for induced breeding and also for the maintenance of gene pool. Dr. B.C.Sarma recalled with nostalgy the significant contributions made by the State Fisheries Department in popularising fish breeding technology among fish farmers in the past four decades through successful implementation of several schemes and projects associated with fish farmers and fishermen of the State. The crowning glory of all these efforts was that the State achieved the first place in inland fish production at national level and earned the distinction of being the recipient of the best fish productivity award for the last 10 years. The rate of growth in the fisheries sector of the State was an average of 9.3% in comparison to the national average of 4.3%. He was highly appreciative of the initiatives taken by the fisheries department in introducing the system of releasing 20 lakh numbers of fish fingerlings in the various riverine systems of the State, on an annual basis.

In his presidential address, Mr. Kironmoy Nanda, complimented the fish farmers of the State for their dedicated efforts in raising the fish production of West Bengal, in earning the prime place in the Sector, and in enabling the State to win the best fish productivity annual awards consecutively for the past ten years. He lamented that the fishery sector had not been receiving the importance that it deserved from the Government of India.

Welcoming the declaration of 10 July as Special Fish Farmer's Day by the Government of India, he hoped that this would be the beginning of the real recognition of the importance of fishery sector by the Centre, to fortify the interest that was generated after the advent of Fish Farmers Development Agencies. Mr. Nanda spoke on the successful and significant achievements of the Fish Farmers' Development Agencies of the State in the implementation of Culture Fishery Development Programmes. He said that the achievements were far higher compared to the other States. He complimented the fishery officers of the State Fisheries Department for their dedicated work in transferring the technologies successfully among the fish farmers/fishermen. He mentioned that, while West Bengal possessed only 5% of national fishery resources, its contribution to inland fish production of the country was of the order of 35% of the inland fish production of the country. He also highlighted the achievements in respect of upgradation of the socio-economic conditions of the fish farmers/fishermen of the State.

Dwelling on future course of action, Mr. Nanda said that the accent would be on the following:

1. Upgrading socio-economic conditions of the weaker sections in the fishery sector.
2. Inducting unemployed youth into the fishery sector for the purpose of bringing derelict water bodies of the State under fish farming and to take needed

Dignitaries on the dais at the Special Fish Farmers' Day Celebration at CICFRI, Barrackpore.

Mr. Kiranmoy Nanda Minister for Fisheries, Govt. of West Bengal being felicitated at CICFRI.

Mr. Nilratan Ghosh, veteran fish farmer, being felicitated by Mr. Kiranmoy Nanda.

Mr. Hiralal Chaudhuri being felicitated by Mr. Kiranmoy Nanda.

Orissa: Dr. B.C. Behera, Dy. Director, MPEDA, addressing participants at Fish Farmers' Day Celebrations in Bhubaneswar.

Orissa: Mr. Tapan Kumar Behera, Joint Director, addressing participants at Fish Farmers Day Celebrations in Bhubaneswar.

At CIFA, Bhubaneswar: A Fish Farmer addressing the participants. Dr.R.K.Jana, Director, CIFA is at the centre on the dais.

FISH FARMERS' DAY
Assam: The Minister of Fisheries, Assam, Dr. H. Saikia delivering inaugural address as the Chief Guest

Gujarat: Mr. P.K. Parmar, Commissioner of Fisheries, inaugurating the Fish Farmers' Day at Gandhinagar, Gujarat

Value-added products: Display Counter set up at CIFE, Mumbai on Special Fish Farmers' Day which attracted considerable attention of the participants

विशेष मच्छिमार दिन

Maharashtra: On the Dias L to R: Mr. Meshram, Dy. Dr. of Fisheries, Mr. Appalwar, commr of Fisheries, Mr. Devkate, Fisheries Minister, Ms. Nita Chowdhury, Union Jt Secretary Fisheries, Mr. Tandel, Vice Chairman, MFDC, Dr. Somvanshi, DG, FSI.

Maharashtra: Ms. Nita Chowdhury, Union Joint Secretary (Fisheries), felicitating Ms.Ranjana Nakova, Chairman, Martand Prasanna Coop. Society, Colaba, Mumbai.

Maharashtra: Minister for Fisheries felicitating Mr. Pagdhare, Chairman, F.C.S Mahim.

Maharashtra: Minister for Fisheries felicitating Dr.K.A. Dongre, Dy. Director of fisheries, State Fisheries Dept.

CENTRAL INSTITUTE OF BRACKISHWATER AQUACULTURE
(INDIAN COUNCIL OF AGRICULTURAL RESEARCH) CHENNAI-34
FARMERS MEET
AT MUTTUKADU EXPERIMENTAL STATION OF CIBA

Chennai: Special Fish Farmers' Day celebration at Muthukadu Research Centre of CIBA. Dignitaries on the dais.

Chennai: View of participants at the SFD celebrations at Muthukadu Research Centre of CIBA.

Faridabad, Haryana: Dignitaries on the dais at the SFD function. Mr. B.S. Saharan, Dir of Fisheries, addressing the participants.

Faridabad, Haryana: A view of farmers who participated in the SFD function.

steps to preserve fisheries of ponds in the city and other urban areas; and

3. Ensuring the highest productivity in an eco-friendly manner and enabling the farmers to market their products soon after harvest at the pond sites itself for the present and in the meantime providing needed centralised cold storage facilities.

It was appealed that the Government of India should develop a comprehensive plan for the entire inland fishery sector of the country, taking into account its enormous potential for augmenting national income and the per capita earnings of all those dependent on this sector.

Concluding, he exhorted the fish farmers, fishermen, fishery scientists, fishery officers, technologists and other functionaries to treat every day as "fish farmers day" and to work in harmony for the total development of the fishery sector of the State.

Mr. B.K.Roy, Director of fisheries, West Bengal proposed a vote of thanks.

AT CICFRI: The Special Fish Farmer's Day was celebrated with enthusiasm at the Central Inland Capture Fishery Institute, Barrackpore.

It was organised at Sukanta Sadan, Barrackpore. Inaugurated by Mr. Kiranmoy Nanda, Minister for Fisheries, Government of West Bengal, it was attended by eminent scientists, Prof.Ashim Bhattacharya, Vice Chancellor, West Bengal University of Animal and Fishery Sciences, Prof.Debabrata Dasgupta, Vice Chancellor, Bidhan Chandra Krishi Viswavidyalay, Dr.P.Das, Ex.Director, NBFGR, Prof.S.K.Konar and Prof. A.R.Khudabux, Kalyani University, Scientists of CICFRI, CIFA, CIBA, CIFE, officials of the State Fisheries Department and NGOs. Around 300 fish farmers participated.

Mr. Kiranmoy Nanda, Dr.Hiralal Chaudhuri and veteran fish farmer Mr.Nilratan Ghosh were felicitated on the occasion for their outstanding contributions for the development of culture fishery industry of the country.

ASSAM

The Department of Fisheries, Assam, celebrated the Special Fish Farmers' Day at Meen Bhawan, Guwahati. District Fishery Development Officer, Kamrup, played a major part in the celebrations. Glowing tributes were paid at the function to the fish farming community, to fishery workers at all levels and to the Research workers for their significant contribution to the fish farming sector and the National economy.

The State level celebrations were presided over by Dr. B.K.Gohain, Commissioner and Secretary, Department of Fisheries, Assam. Dr. Hemoprabha Saikia, the Minister of Fisheries, Assam, graced the occasion as the Chief Guest. Dr.M.M.Goswami, Professor, Department of Zoology, Gauhati University and Dr.M.D.Choudhary, Senior Scientist, CICFRI, Guwahati Centre, were the prominent guests who were also honoured. Mr. A.K.Phukan, Director of Fisheries, Assam, welcoming the participants, recalled to their attention the revolutionary developments in freshwater fish culture all over the country as an offshoot of the success in induced breeding of carps achieved by Dr. Hiralal Chaudhuri on 10 July 1957.

The Minister of Fisheries, Assam, Dr(Mrs.) Hemoprabha Saikia, in her presidential address spoke extensively on the importance of quality fish seed production. She announced that from now onwards progressive fish farmers would be selected on an annual basis for conferring awards on 10th July. The Commissioner and Secretary, Fisheries Department, emphasised the need for development of capture fisheries too and urged the fish farming communities to step up fish production to such a level and in such a manner that the need for import of fish from outside the State could no longer be there.

The Special Fish Farmers' Day was also celebrated with enthusiasm in all the district headquarters. The District Fishery officers organised meetings, seminars and workshops. There was an overflowing participation in the celebrations by fish farmers. The district officials and a large number of NGOs, social workers and scholars also took part in the function.

NAGALAND

The Fish Farmers' Day was celebrated by the State Fisheries Department at Brooder Fish Farm, Dimapur. Mr.Kakheto, Minister for Fisheries, Nagaland, was the Chief Guest. Among the distinguished guests were Mr. Amerdeep S. Bhatia, Dy.Commissioner, Dimapur, Scientists of ICAR from Jarnapani farm and the Secretary, Fisheries.

Mr.H.Kent, Ex.Officio Director of Fisheries, Nagaland, Kohima was the Chairman of the function. Mr.Senli Ao, Joint Director (Fisheries), Kohima, and his team of officers among whom were Mr.C. Imti Longkumer, Fishery Biologist, Dimapur, Mr. Kevisa Kense, Chief Executive Officer, FFDA, Dimapur, and several other participants..

Mr. Kent welcomed the Minister and the participants. In his address Mr. Kakheto, Minister for Fisheries, while explaining the importance of the Day said that the purpose of the celebration was to focus attention on the contributions so far made and the major contributions the aquaculture sector could make in the future to contribute to the Nation's economy and to guide and encourage fish farmers in their endeavour. The Minister told the participants that all efforts were being made to maximise fish production in the State through implementation of various fishery related schemes. It was pointed out that the total fish production of Nagaland during 2000-2001 was 5000 t. The State had also produced 50 million nos. of fish seed during the year. Because of the setting up of new fish seed farms and also because several private entrepreneurs had taken up fish culture as their profession, there had been a substantial increase in fish production, he said. It was mentioned by him that a Fish Farmers Training Centre, an Awareness Centre and also one Laboratory were now being set up and these were expected to be completed by March, 2002. The Government was taking steps to set up two more Fish Farmers Training Centres. It was mentioned by him that providing training to interested persons in fish farming was being accorded the highest priority and the Government had set up a target for providing training to not less than 200 persons in fish farming during the 10th Plan.

Expressing happiness that several farmers travelled all the way from different districts to participate in the celebrations, he exhorted the farmers to intensify their efforts so as to achieve self-sufficiency in fish production to meet the requirements of the State and to generate greater employment. He thanked fish farmers of Nagaland for having accomplished a splendid job in augmenting production of fish seed and fish in the State. He explained the steps taken by the government to augment the incomes of fish farmers and fish workers. He told that the department proposed to recognise the contributions made by the fish farmers by awarding certificates and prizes and supplying fish seed.

Concluding, he expressed the hope that the farmers would go back with the determination to achieve outstanding results in fish production.

MEGHALAYA

Workshops, Seminars, and Fish Farmers' meetings held in the various districts of the State marked the Special Fish Farmers' Day celebrations. Meritorious farmers in each of the districts were selected and they were awarded special certificates of merit with a view to encouraging them in their profession.

The Deputy Director of Fisheries was the Chief Guest at the celebrations held in Jaintia hills district. In other districts, the Assistant Directors of Fisheries were the Chief Guests. The Director of Fisheries himself was the Chief Guest in East Khasi Hills, Shillong, where a large number of progressive fish farmers and the trainees under the Fish Farmers' Development Agency participated.

ARUNACHAL PRADESH

Special Fish Farmers' Day was celebrated enthusiastically in the various Districts of the State. The celebrations held at Mahdevpur in Lohit district were very impressive. Mr. D.Debroy, Additional Deputy Commissioner, Namsai, inaugurated the function in the presence of fisheries officers and fish farmers of the District. A Workshop was organised by the department on the Day to mark the occasion. 150 fish farmers participated in the Workshop. Mr. S.Pul, District Fishery Development Officer, Lohit District, explained to the farmers the importance of the Day. Fish seed was distributed to progressive fish farmers of the district to mark the occasion.

TRIPURA

The Special Fish Farmers' Day was celebrated in all sub divisions of Tripura. Several fish farmers, dignatories and public representatives from Panchayat bodies participated in the seminars that were conducted at various sub divisional headquarters. Detailed discussions were held focusing on the contribution of aquaculture sector to the National economy. The objective of the celebrations was also explained by the officers. It was announced during the celebrations that the department had decided to award prizes and certificates to the best fish farmers of the State on annual basis. All India Radio, Agartala, and other centres of the State, Doordarshan Kendra, ETV and local newspapers gave coverage to projects details of the programme so as to inculcate awarness among the farmers of the State.

SIKKIM

The Special Fish Farmers' Day was celebrated at the Fisheries Directorate at Gangtok, Sikkim. The function was chaired by Mr. T.R.Sharma, Secretary-cum-Principal Chief Conservator of Forests. Thirty fish farmers of the State participated in the celebrations.

Mr.P.W.Bhutia, Joint Director of Fisheries, highlighting the pioneering work of Dr.Hiralal Chaudhuri in induced breeding of major carps, told the participants about the success achieved in the breeding of grass carp at Rothak Circular Hatchery. The Chairman exhorted the farmers to optimise their efforts at fish culture, availing of all the facilities provided by the Government. He mentioned that the State depended on their hard and devoted work in stepping up fish production in Sikkim, to such an extent that there would be no need to bring fish from outside. There was an active interaction between the farmers and the technical personnel in regard to various aspects of fish seed production and culture activities. The main complaint from the farmers was that fish seed was not being made available to them on time. They also desired that quality of fish seed supplied to them must be maintained. The Joint Director of Fisheries told them that these two aspects would be taken care of and assured that the seed that was being supplied now was of good quality. However, all efforts would be made to ensure supply of seed of high quality to the farmers well on time for stocking, he added.

The problem of seepage of water from fish ponds also came up for discussion. The farmers were informed that the department would take all needed measures to see that this problem was solved. Mr. P.W.Bhutia, member secretary of Fish Farmers Development Agency too, appraised the participants of the significant achievements of the Agency. He also told them that the upper limit of subsidy per unit cost of individual ponds had been raised to Rs.20,000/- from Rs.8,000/-from this year. Thus, the individual farmers selected by the Agency to set up their own ponds in the coming year would be eligible to receive subsidy at the revised rate. He exhorted the fish farmers to put forth their best and increase aquaculture production in the State and hoist Sikkim as one of the important culture fish producing States on the Indian map.

MANIPUR

The Special Fish Farmers' Day was observed with great fervour devotion. A Workshop on "Impact of Induced breeding in the development of Fisheries in Manipur was conducted as part of the celebrations.

The function was chaired by Mr. N.Biramani Singh, Director of Fisheries, Manipur. There was a large gathering among whom were prominent fish farmers, district level officers of the Fisheries Department, Manipur and several others interested in fish farming.

HIMACHAL PRADESH

A Farmers' Meet was organised at Deoli fish farm, the leading fish farm of the State. A large number of progressive farmers and Panchayat functionaries, besides the departmental officers participated in the function.

Presentations were made by the technical officers of the department on various topics such as hatchery practices, carp seed raising, carp culture, on role of Panchayati raj institutions in the promotion of fisheries programmes and on various subsidy-oriented schemes initiated by the department under self-employment programme. A highlight of the celebrations was the broadcasting of various success stories of the on-going fisheries schemes of the department over the All India Radio, Shimla. Dr. Kuldip Kumar, Director of Fisheries, spoke on various financially assisted schemes in operation in the State for raising of carp and trout.

HARYANA

The State Fisheries Department of Haryana celebrated the "Special Fish Farmers' Day" at Badkhal Lake, Faridabad. Progressive Fish Farmers' from all the Districts of Haryana, besides several fish seed producers participated in the function. Mr. S.C.Jain,Deputy Commissisoner, Faridabad participated in the function. He evinced keen interest in the organisation of the function. He was present all through the celebrations. Dr. Usha Mauja, Principal Scientist, CICFRI's Unit at Karnal and Mr. N.K.Chadha, Fisheries Scientist, CIFE Unit, Rohtak, were among several distinguished participants. The Central Institute of Fisheries Education, Rohtak Unit, set up an exhibition depicting various inland fish culture activities at the venue of the function and it attracted a large number of visitors.

Owing to inescapable pre-occupations, the Minister for Fisheries, Haryana, Mohd. Ilias could not be present on the occasion. His presidential address was however read out at the function. The message of Mr. Nitish Kumar, Union Minister of Agriculture was also read out on the occasion. Dr. Hiralal Chaudhuri who was informed about the celebrations sent a message conveying his best wishes for the success of the function.

Mr. B.S.Saharan, Director of Fisheries, Haryana, welcoming participants, told the gathering that, although a non-traditional fishery State, Haryana recorded outstanding progress in fish culture and the credit for this went to the hardworking and devoted farmers of the State. He also told the delegates about the historic achievement of Dr.Hiralal Chaudhuri in respect of induced breeding of major carps. But for this epoch-making event, there would not have been so much of progress in the production of major carp seed and increase in major carp production in the State, he said. He added that this was particularly true in respect of Haryana where no tradition of fish culture existed but the State had made remarkable strides in the sector, mostly because of the eventual standardisation of induced breeding work. He brought to the notice of the participants that India now occupied No.2 rank in inland fish production next only to China and credit for this went to Dr.Chaudhuri and to the devoted contribution by the fish farmers. The farmers of Haryana, starting from the scratch had now progressed to a level of producing 4 tonnes of fish per hectare per annum which was far above the national average.

Fish seed producers, farmers and scientists shared their experiences at the function. One after another, the farmers told the participants the manner in which they acquired the technology and implemented it steadfastly. They had also invited the participants to visit their hatcheries and farms.

Dr. Usha Mauja and Mr.N.K.Chadha emphasised the need for proper management of broodstock before subjecting the same to induced breeding. They had cautioned the breeders to ensure that no inbreeding took place. Mr.S.C. Jain, Deputy Commissioner, Faridabad explained to the delegates that fisheries was part of agriculture for the simple reason that pond waters also received nutrition from the bottom soil as in the case of agriculture. For fish culture too, ponds were prepared in the same way as agriculture fields were prepared and the terminology of culture was also more or less the same in both the culture systems. In this background he emphasised the need and justification for providing facilities and inputs such as water at the same rates on par with agriculture. He assured the fishfarming community that all help and assistance with regard to leasing of village ponds for fishery development would be extended. The district administration would also extend all needed help for securing inputs and financial assistance. The General Manager, NABARD also assured the farmers that NABARD was always in the forefront to extend refinance to commercial banks to lend money to fish farmers.

There was a lively discussion on the problems faced by the fish farmers which consisted of those related to supply of fish seed and other inputs, and infrastructural facilities for storage and marketing of harvested produce. The farmers appealed to the authorities to provide electricity and water at the rates on par with agriculture sector. Another request of them was to organise tours for them to visit farms in other States so as to understand the manner in which fish culture was being carried out at various centres of those States. There was positive response from fisheries and other departments on this representation.

An important point that came to light during discussions was that the Fish Farmers Development Agency, Faridabad, had instituted cash prizes of Rs.2,100/- each to be given to outstanding fish seed producers as incentive.

Apart from the celebrations at State level at Badkhal Lake, the Special Fish Farmers' Day was celebrated at divisional levels, i.e., at Rohtak, Hisar and Kurushetra. The event attracted prominent coverage in all leading newspapers of Haryana.

RAJASTHAN

The Special Fish Farmers' Day was celebrated at all the District Fisheries centres in the State with the participation of a large number of farmers. Discussions were held on the status of fish farming in Rajasthan and the measures to be taken for covering of additional water area under culture and for stepping up per hectare production.

In Udaipur, a special function was organised at the initiative of the Assistant Director of Fisheries, Mr. Ismail Ali Durga who is also in charge of the newly revived fish farmers development agency of Udaipur District. The function was held at the fisheries Laboratory at Fatehsagar. The staff of the Limnology and Fisheries department of the Maharana Pratap University of Agriculture and Technology and of the Department of Zoology of M.L.Sukhadia University, Udaipur, participated in the proceedings. Special invitees who took part were the retired members of the Department of Fisheries of the State Government. Mr.D.K.Raju, Research Assistant in the newly established Inland Brackishwater Aquaculture Laboratory, Udaipur, established by the Central Institute of Education, Mumbai participated. Private aquaculturists formed an important segment of the gathering. Mr.Alok Jain, one of the progressive fish farmers, actively participated in the discussions. Mr. I.A.Durga, the Assistant Director of Fisheries appraised the audience about the importance of the Day and spoke on the activities of the FFDA, Udaipur. He called upon aquaculturists to take advantage of the various schemes taken up by the State and Central Governments through FFDA.

The key note address was delivered by Prof. V.S.Durve. He appealed to the State Fisheries Officers to popularise aquaculture among villagers by organising poster shows, film shows, awarness programmes, etc. He proposed the inclusion of aquaculture in the syllabus of agriculture schools in the tribal belt, with one optional paper on fisheries. He had also suggested that the state secondary education directorate/ICAR might be approached for securing needed financial assistance for the employment of additional staff and for creating the needed field infrastructure for the implementation of the suggested programme and for inclusion of aquaculture as one of the subjects at agricultural schools in tribal belt.

GUJARAT

There are 25 Revenue Districts in Gujarat and Fish farmers Development Agencies are functioning in 17 Districts. The state has three distinct geographical regions, the peninsular Saurashtra, desert and marshy Kutchh and the main lands of south central and north Gujarat. It is estimated that the state has 3,04,544 ha of freshwater area in the form of village ponds, irrigation tanks, reservoirs, and lakes. With a view to promoting fisheries development, the state has been divided into five different regions, and the Deputy Directors of the concerned regions monitor the development activities.

To commemmorate the Special Fish Farmers' Day, region-wise programmes were organised by the concerned Regional and District Officers.

Rajkot and Veraval Region: This region consists of seven Districts viz., Surendranagar, Rajkot, Jamnagar, Bhuj, Junagadh, Bhavnagar, Porbundar and Amereli. Since inception of FFDAs in these districts, an area of 50,268.29 ha has been covered under fish culture, 7549 numbers of fish farmer have been trained.

On 10th July, 2001, a 'mela'/workshop was organised at Rajkot at Lok Vignan Kendra. Fishermen, President / Secretaries of Co-op. Societies and Fish farmers from the above mentioned Distrits attended the workshop. On the same day an exhibition was also organised at Dr.Shyama Prasad Mukherji Art Gallery of Rajkot, where details of different schemes implemented by the Department and its achievement were exhibited.

Baroda Region: This region consists of seven District namely Anand, Nadiad, Vadodara, Panchmahal, Dahod, Bharuch and Narmada. Since inception of FFDAs, so far 6158.75 ha of area has been developed for fish culture and 5570 numbers of beneficiaries have been imparted training. 840.03 ha of water area have been renovated so far and 260.41 ha of new ponds have been constructed with the assistance of FFDA.

As part of the Special Fish Farmers' Day, a workshop has been organised at Water and Land Development Institute, Anand. Fish farmers from all the above mentioned Districts have participated in the workshop. Deputy Director of Fisheries from Gandhinagar presided the function. Topics like 'Fish culture in village ponds', 'Mono culture of Scampi', 'composite fish culture' were discussed and the participants were given informative brochures.

Surat Region: This region consists of four Districts namely Surat, Bulsar, Dangs and Navsari. Since inception of FFDAs, so far, 3356.79 ha of area has been developed for fish culture and 3722 beneficiaries have been imparted training. Under renovation of ponds programme 2026.32 ha have been covered so far and 85.96 ha of new ponds have been constructed with assistance of FFDA.

In this region, Special Fish Farmers' Day was celebrated at various places of the above mentioned districts. At Madhuban, a 'Mela' of the displaced tribals of Madhuban reservoir was organised. 52 tribals attended the function. At Umargaon, under the auspices of the Maroli Matsyodyog Sabakari Mandali, a function was organised by the local officer in which 44 fish farmers participated. At Ukai, a Workshop on "Ukai Reservoir Fisheries Development" and "Narmada Van Mahotsav" was organised by the Inland fisheries Development Center, Ukai, as part of celebration. 300 displaced tribals of Ukai reservoir participated in the Workshop. The concerned technical officers explained to the participants present technological advancement in the fisheries sector and the need for increased people's participation in the endeavour.

Prof. N.D.Chaya, Retd. Principal of Fisheries Science College, Veraval, inaugurated the workshop. On this occasion a booklet titled "Matsya Beej Utpadhan ane Uchher" was released by the Chief guest Jijubhai Barad. In his inaugural speech, Prof. Chaya emphasized on the need for further research in fisheries sector, stregthening of Lab to Land programme and explained recent advancements of technology in culure fishery sector. The concerned district officers provided answers to Fish farmers from various districts like Surendranagar, and Rajkot on several problems raised by them.

Ahmedabad Region: This region consists of five Districts namely Ahmedabad, Mehsana, Patan, Sabarkanta and Banaskanta. This central region receives scanty rains during monsoon season compared to south Gujarat. Since inception of FFDAs in these districts, so far 3036.10 ha of area have been brought under fish culture. FFDA has imparted training to 2982 beneficiaries.

Special Fish Farmers' Day was celebrated by organising one day workshop at Udhayabhan Sinhji Cooperative Training Institute at Gandhinagar. Fish farmers of above mentioned districts attended the function in large numbers. The Commissioner of Fisheries, Mr. P.K.Parmar, inaugurated the workshop. District Development Officer Sabarkanta and Managing Director, GFCCA Ltd. participated in the function along with Deputy Director of Fisheries, Ahmedabad region and Assistant Directors of the Districts. In the inaugural speech the Commissiner spoke on the different schemes operated by the department for the upliftment of socio-economic condition of the fishermen of the State. He appealed to the fish farmers to adopt the recent technologies developed in the fisheries sector to obtain increased per ha production.

KARNATAKA

Special Fish Farmers' Day was enthusiastically celebrated at the Veterinary College, University of Agricultural Sciences, Bangalore, on 10 July 2001.

The event was jointly organised by the State Fisheries Department and the University of Agricultural Sciences. Over 150 fish farmers, several representing fishermen's Cooperative Societies, besides fisheries officials and scientists participated.

Dr.K.V.Deveraj, former Vice Chancellor, University of Agricultural Sciences, Bangalore, inaugurated the celebrations, with Dr.V.Veerabhadraiah, Director of Extension of the University in the Chair. The Chief Guest was Mr.H.S.Veerappa Gowda, Joint Director of Fisheries.

Dr. Vasudevappa, Head, Fisheries Research Station, Hesaraghatta, welcomed the participating fish farmers, scientists, the Chief Guest and other dignataries. Recalling the epoch making work of Dr.Hiralal Chaudhuri, which had transformed the complextion of inland fish culture of the country, Karnataka, in line with other States, also adopted the induced breeding technology developed by Dr.Hiralal Chaudhuri for augmenting fish seed production and this has led to the increase in annual fish production of the State to a level of 1,30,000 tonnes as in 2001 against the production level of 50,000 tonnes at the end of 1960. He observed that there was vast scope for augmenting inland culture fish production to around 5,00,000 tonnes provided available resources of the State are scientifically harnessed.

He eulogised the contributions of Indian fishery scientists, particularly Dr.Hiralal Chaudhuri and Mr. K.H.Alukunhi, whose remarkable contributions played a major part in the development of the culture fishery sector to the present level. He exhorted the younger generation of scientists to derive inspiration from the progenitor of the technology of induced breeding. He had pointed out that while so much had been accomplished, the achievements had to be taken further by promoting culture of indigeneous carps such as *Labeo calbasu, L.fimbriatus,* and *P.pulchellus.* He was against introducing culture of exotic fishes, without properly understanding the long range affects of such introductions on the indigenous species. He appealed to the fishermen to make the best use of the available technologies for optimising culture fish production and deriving substantial economic returns.

Mr. H.S. Veerappa Gowda, Joint Director of Fisheries, and Dr. R. Ramakrishna, Deputy Director of Fisheries, exhorted the farmers to avail of this annual event to highlight their problems and to identify the areas of assistance and support they would need from the authorities for the upgradation of their professional capabilities and for raising fish production thereby.

In his presidential address Dr. V.Veerabhadraiah expressed his happiness at the overwhelming participation by the fish farmers in the celebrations. He exhorted the farmers to avail of the packages of practices of fish culture developed by the Fisheries Research Institutes for augmenting culture fish production.

There was an interaction session that followed. The fish farmers, scientists and fisheries administrators paricipated in the session under the chairmanship of Dr.K.V.Devaraj. The farmers raised several issues which were discussed at length. The points raised clearly indicated the depth of experience the farmers had gained. The points made were:

a) Reasons for the stunted growth of major carps in tanks and ponds needs study.

b) Supplies of major carp fish seed are often not made in time and at the places needed. The system has to be improved.

c) Measures to be taken to reduce fish seed mortality during early rearing period.

d) Techniques to be followed for control of aquatic feeds have to be demonstrated.

e)Techniques to be adopted for eliminating tilapia menace in culture ponds have to be popularised.

f) Techniques for culture of freshwater prawns.

g) Culture of and Thai magur has to be prevented, and.

h) Supplies of genetically improved Rohu seed developed by CIFA to the farmers have to made.

The other issues raised were:

a) The method to be adopted to improve cost-benefit ratio in composite fish culture, b) provision of effective insurance coverage over fish crops, and c) in respect of reforming the policy of the Government so as to ensure that the fishery rights of Government waters are given to the deserving.

The scientists who participated in the event included Drs.Y.Basavaraj, K.V.Mohine, G.Y.Keshavappa, P. Kumariah, Chakravarthy, D.S.Krishna Rao, Gopal Reddy, Kaber Naik and several others.

Dr. G.Y.Keshavappa proposed a vote of thanks.

KERALA

The Department of Fisheries, Govt. of Kerala celebrated the Special Fish Farmers Day by organizing successfully Fish Farmers' Meets in all the districts of the state. There was participation of fish farmers and the public at the Meets. Seminars, Symposia, Workshops and Audio Video Programmes on fisheries sector were also conducted.

Some of the important highlights are as follows: The State Level inaugural function was conducted by the Department of Fisheries in association with CMFRI, CIFT and College of Fisheries, Panangad at Ernakulam on 10th July, 2001. The Minister for Fisheries, Prof. K.V. Thomas inaugurated the function. Mr. T. Thankappan, Director of Fisheries and Heads of CMFRI, CIFT and College of Fisheries offered felicitations on the occasion. A one-day seminar on 'Aquaculture and Related Problems' was also arranged in which 83 active fish farmers participated.

Two Fish Farmers' Meets were conducted on the Day in Thiruvananthapuram District. A number of Fish Farmers and other public actively participated in the functions. The venues were one at Vembayam in Nedumangad Taluk and the other at Thirupuram in Neyyattinkara Taluk.

In Kollam District the functions were arranged at Thazhava near the fish pond of a farmer. The Member, District Panchayath, Kollam inaugurated the Special Fish Farmers Day functions and several dignitaries made felicitations. After that, a class was conducted on 'Induced Breeding & Fish Culture' for the benefit of fish farmars.

The Chairman, Standing Committee, District Panchyath, Thrissur, inaugurated the Special Fish Farmers Day function at Thrissur. Dr. Aravindakshan, Scientist (Rtd), CIFA, Orissa, conducted a class for the fish farmers on 'Induced Breeding Technique & Culture of Indian Major Carps'. Dr. Antony, Professor, Kerala Agriculture University, Mannuthy, also spoke on that occasion.

In Kannur district, a Fish Farmers' Meet was organised at the Kannur Co-op Town Bank Auditorium. In this function several fish farmers, shrimp farmers and mussel farmers actively participated throughout the programme.

A seminar on 'Prospects of Fish Culture in Wayanad District' was arranged in Wayanad District on the Special Fish Farmers Day. A number of fish farmers actively involved themselves in the seminar and also in the whole programme.

One-day seminars on 'Induced Breeding & Fish Culture' were conducted in other districts also on 10th July, 2001.

The celebrations evoked good response from fish farmers and the public in general all over the state.

UTTAR PRADESH

Special Fish Farmers' Day, 2001, was celebrated by U.P.State Fisheries Department in the various districts of the State enthusiastically. In most of the celebrations, fish farmers' meetings were organised with a large number of fish farmers participating. The fisheries experts of State Fisheries Department, U.P., discussed the various aspects of fish culture with fish farmers and advised them to adopt proper fish culture technologies for obtaining better production from tanks and ponds. In this context, solutions to the problems pointed out by the participating farmers have been suggested by officials of State Fisheries Department.

Reports on celebrations organised in Gujart Tal (Jaunpur), Sanya Hatchery (Faizabad), Ghazipur and Allahabad and others, about successful Special Fish Farmers' Day celebrations have been received by the Directorate of Fisheries.

The State Fisheries Officials suggested to fish farmers culture of new candidate species for diversification of aquaculture practices. The officials of government hatcheries assured the supply of good quality seeds to fish farmers.

The owner of Shekhar Fish Farm, Phulwaria, Gorakhpur, Mr.Prashant Kumar Singh organised a one day visit on Special Fish Farmers Day for small scale fish farmers of Gorakhpur to show the fish culture operations at his farm. Overall, the Special Fish Farmers Day was celebrated remarkably well in U.P. State.

UTTARANCHAL

Special Fish Farmers Day was celebrated befittingly at College of Fisheries Science, Pantnagar. In this context, the fish farmers had the opportunity of visiting the farm and hatchery attached to the college. The faculty members of the college demonstrated to the farmers fish culture techniques and fish hatchery operations. Fish farmers of Tarai region of Uttaranchal took keen interest in all the activities. Dr.U.P. Singh, Dean, College of Fisheries, Pantnagar, had played a leading part in explaining the technologies of culture and hatchery seed production to the participating farmers.

BIHAR

Freshwater aquaculture has contributed significantly to GDP of Bihar. In Bihar, as in other states, Induced Breeding Technology has virtually replaced the practice of wild spawn collections from rivers. Spawn production through induced breeding and fry production (out of the spawn produced) through circular hatcheries are now in vogue.

Special Fish Farmers' Day was celebrated under the umbrella of Fisheries Officers' Association in Patna. The guest of honour was Mr. R.N. Chaudhury, Incharge Director Fisheries, Bihar. He explained to the participants the importance of the Day. He said that the message of the Day would be made known to the public through wide publicity in daily newspapers.

Addressing a gathering of leading fish farmers, NGOs, departmental officers and private feed hatchery owners, Vice-President of the Fisheries Officers' Association Mr. N. Ahmad told that 10th July 1957 was a day of giant leap in the history of freshwater aquaculture. He suggested to the Director of Fisheries to have special pamphlets designed, printed and distributed in important Melas of the State like Sonepur and Rajgir to generate awareness among the people about the importance of the day.

Mr. Manoj Kumar, Deputy Director of Fisheries said that 10th July would be observed in the State every year as Special Fish Farmers' day with the same fervour and dedication as on this occasion. He hoped that the fisheries department would work towards enabling the private sector to set up at least five new private fish seed hatcheries in the state every year.

The function came to a close with the chanting of the slogan "Raise Fish Seeds, They would Raise You", and a vote of thanks.

MADHYA PRADESH AND CHHATTISGARH

The Special Fish Farmers' Day was celebrated with enthusiasm and fervour in Madhra Pradesh and in Chhattisgarh States. In Madhya Pradesh at a function in Bhopal held by Matsya Mahasangh, participated by a large number of fish farmers, and several officers, Mr. Hiralal Silavat, fisheries minister reiterated the resolve of the Government of Madhya Pradesh for the economic and Social upliftment of fishermen of the State. Celebrations were also held at Gandhinagar, Halali and Bargi. The function in Chhattisgarh was held at the Directorate of Fisheries in Raipur. At all the meetings, the various Governmental programmes related to the welfare of fish farmers/fishermen were explained.

JHARKHAND

Special Farmers' Day was celebrated at Doranda fish farm, Ranchi. The Farmers' Meet, organised on the occasion, was participated by around 100 fish farmers and fishermen. It was presided over by P.K.Jajoriya, Secretary, Animal Husbandry and Fisheries, Government of Jharkhand. Several others participated in the meeting, prominent among whom were Mr. Rajeev Kumar, Regional Director of Fisheries, Mr. Ashish Kumar, Deputy Director, Mr.V.P. Srivastava, Assistant Director of Fisheries (Research), Mr.L.B. Sharma and B.V.Bhatt, Assistant Engineers and Aquaculture Consultants from Gram Vikas Trust (an NGO with British aid), Dr.S.K.Singh, Assistant Professor (Fisheries), Birsa Agriculture University, and several fish farmers from Ranchi, Kanke, Bero, Khunti, Ratu, Karra and Bandu blocks. A number of beneficiaries under Fishermen's Housing Scheme were also present and they were introduced to the participants by the Secretary, Mr.Jajoriya. He highlighted the urgent need for increasing fish production in the State, stating that this would not only augment supplies of fish to the people but would also augment employment opportunities besides toning up income generation. He said that the conditions were congenial for stepping up fish production in the State for the particular reason that the fishery setor had been provided with an increased budget compared to budget provisions in the last few years. He appealed to all those concerned with fish culture to work hard with dedication and zeal.

On this auspicious occasion, a new aquarium house was also inaugurated by the Secretary. All the participants were taken round the aquarium house.

Mr. Ashish Kumar proposed a vote of thanks.

ORISSA

The State of Orissa gave to the Nation the induced fish breeding technology, said Mr. G.K.Dhal, Director of Fisheries, Orissa, adding that it was on 10 July 1957, Dr.Hiralal Chaudhuri achieved the first breakhrough in induced breeding of major carps in the State at Angul when he functioned as a Scientist at the Cuttack Centre of composite CICFRI. The development of the technology had resulted in the total stoppage of collection of fish seed from wild, he added.

Special Fish Farmers' Day was celebrated in Bhubaneswar at a function organised by the State Fisheries Department.

The Joint Director of Fisheries, Mr. Tapan Kumar Behera presided over the function. Large number of fish farmers and fishery entrepreneurs from different parts of Orissa participated in the function. Among the dignataries who participated were Mr.A.B.Ray, Retd. Addl. Director of Fisheries, Mr.S.K.Mohanty, Head, Ex.World Bank-assisted Shrimp Culture and Joint Director, Mr.D.K.Mohanty, Additional Secretary of Fisheries and Animal Resources Development Department, Government of Orissa, Dr. R.K.Jana, Director, CIFA, and Mr.B.C. Behera, Deputy Director, MPEDA.

Dr.N.C.Biswal, Deputy Director of Fisheries welcomed the participants and introduced the dignataries to the participants. Mr. A.B.Roy, chief guest spoke on the occasion. He exhorted the farmers to pursue their profession with even greater dedication aimed at achieving the objective of raising culture fish production in a sustainable manner to the highest possible level in order to restore Orissa to its rightful place in the culture fishiery sector. Mr. S.K. Mohanty said that all efforts should be directed at overcoming shortage in fish supplies, by bringing in more and more water bodies under culture production. He also appealed to the State Government to vest fishing rights over all water bodies in the State Fisheries Department.

Mr.B.C.Behera, highlighted the urgency of diversification of the present culture practices to induct other economic species for culture, which would have export potential. He believed that more and more exposure should be given to the fish farmers of Orissa. Mr. S.Behera, Deputy Director of Fisheries, State Fisheries Department said that the present deficiencies experienced in the transfer of technologies to the fish farmers should be overcome. In order to bridge the gap that existed between extension functionaries and farmers, greater initiative had to be exercised in augmenting and activating infrastructure facilities and promoting a climate that would be conducive for effective extension work.

Mr. T.K.Behera, Joint Director of Fisheries spoke on the need for intensified efforts for achieving higher rate of culture fish production per ha from the present rate of 2 mt/ha. He had pointed out that 63,000 ha of water area was available for utilisation for fish culture in the State. Observing that the fish farmers of the State were still depending on Government fish farms for obtaining supplies of quality fish seed for stocking their tanks and ponds, he emphasised the need to popularise fish seed production in the private sector and wean farmers from their present dependency on govt. fish farms.

Various other speakers emphasised on the need for promoting commercialisation of fisheries sector further, particularly in respect of the culture fishery sector.

CIFA: Special Fish Farmers' Day was celebrated at the Central Institute of Freshwater Aquaculture, Kausalyaganga, amidst overwhelming response from progressive fish farmers, women aquaculturists, fisheries scientists, technical officers, students, entrepreneurs, trainees and research scholars. Dr. R.K.Jana, Director, Central Institute of Freshwater Aquaculture, presided over the function. He read out the special message received from the Union Minister of Agriculture, Mr.Nitish Kumar. Thereafter he articulated the pivotal role of the fish farmers in ushering in blue revolution. Reminiscing over the path-breaking success in induced breeding achieved by Dr. Hiralal Chaudhuri, the eminent scientist of the Central Inland Fishery Research Institute, of which CIFA was once a part, Dr. Jana said that Dr.Chaudhuri eventually achieved the status of international fishery expert. He concluded by saying that major strides in culture fish production had been possible due to joint efforts of farmers, scientists and extension professionals, as a follow up to the outstanding work of Hiralal Chaudhuri.

Dr.S.D.Gupta, senior Scientist spoke on the occasion. Highlighting the past, present and future trends of technological developments in fish breeding, he told the participants about the unique success of multiple carp breeding technology and cryopreservation of milt achieved by the scientists of the CIFA. He said that these had the potential to ensure fish seed availability round the year.

Dr.S.N.Mohanty, Principal Scientist, CIFA, spoke on the trends and perspectives in freshwater fish culture technology development generated by CIFA and the steps taken for the effective extension of the technology to the end users in rural areas.

The participating aquaculturists narrated their experiences and achievements. They also sought solutions to the field level problems faced by them. Mr.B.K.Sahoo, an ex-trainee of KVK from Sarakana spoke on his success in producing over three crore carp spawn at his hatchery in the current breeding season. Mr. Braja Kishore Sahoo of Budhipada narrated his success story in the field of fish culture, in fish breeding, hatchery management and fish seed production. Sustained success of a private joint venture in fish production and hatchery management at Gop under the technical guidance of the extension unit of CIFA was another highlight of the function. A number of scientists and technical officers including Drs.K.J.Ram, S.K.Sarkar, Radheyshyam, R.K.Dey, B.B.Satpathy and S.C.Rath provided answers to number of queries raised by the participating farmers.

At the concluding part of the function, a film on the achievements and ongoing R&D efforts in CIFA was screened for the benefit of the farmers. The function ended with vote of thanks by Dr.S.K.Sarkar, Chief Training Organiser, KVK/TTC.

Mr.P.K.Mishra, Asst. Director of Fisheries-cum-C.E.O., FFDA, Sambalpur organised a seminar to celebrate the Special Fish Farmers Day on 10th July, 2001 at Sambalpur. A total of 62 participants including 40 progressive fish farmers of Sambalpur district attended the seminar which was quite successful. The proceedings of the Seminar will be published in the earliest possible issue of *Fishing Chimes*.

ANDHRA PRADESH

The State fisheries department celebrated Special Fish Farmers' Day by organising meetings at various district centres and fish farms. Experts who participated in the celebrations explained to the farmers the latest technologies in respect of achieving increased fish/shrimp production. Emphasis was also laid on disease control methods, etc. Pamphlets related to fish culture, disease control, etc., were distributed among the farmers.

TAMILNADU

Special Fish Farmers' Day was celebrated in all the districts of the State, organised by the Assistant Directors of Fisheries (Inland) and Aquaculturists. These celebrations were held in association with Universities, Central Institutes and other concerned departments.

The Fisheries Staff Training Institute, Chennai celebrated the event. 41 fish farmers of Tiruvellore and Kanchipuram districts participated in the programme and shared their experiences in aquaculture.

Dr.M.Parameswaran, Joint Director of Fisheries (Inland), explained the importance of the Day and its significance. He told the participants about the various schemes related to aquaculture now under implementation and the benefits that could be derived by the farmers through participation in the schemes. Mr. N.Nallu Chinnappan, Joint Manager, Tamilnadu Fisheries Development Corporation, who was the Chief Guest, made several suggestions in respect of achieving successful fish culture operations for the benefit of the fish farmers who participated.

Films on aquaculture and induced major carp breeding were also screened on the occasion. The farmers were also taken on a field visit to Muthukadu, field centre of the Central Institute of Brackish Water Aquaculture. Here they were taken round the farm and the activities of the Centre were explained.

Special Fish Farmer's Day was celebrated in various other centres of the State, prominent among which were Madurai, Chidambaram Palani, with the participation of a large number of fish farmers.

AT CIBA: Special Fish Farmers' Day was also celebrated at Central Institute of Brackishwater Aquaculture at its Muttukadu Experimental Station. The function was presided over by Dr. G.R.M. Rao, Director, CIBA. Farmers from all neighbouring districts participated in the celebrations, apart from the trainees from the Tamilnadu Fisheries Staff Training Institute and officers from the State Fisheries Department. Dr. N. Kalaimani, Principal Scientist in charge of Extension Division of CIBA welcomed the participants. He explained the significance of the Day, while also highlighting the achievements of CIBA including induced captive breeding of seabass *(Lates calcarifer)*.

In his presidential address the Director referred to the achievements of Dr. Hiralal Chaudhuri. He called upon the farmers to come forward to take up fish farming in areas which had not yet been brought under fish culture. Dr. R.Thirunavukkarasu, Project Leader, CIBA's breeding project, gave a special talk on the technology of captive breeding of the CIBA.

The guest speakers, while exhorting the farmers to adopt the latest technologies in fish seed production and fin fish production, admired the scientists of CIBA for their research and extension achievements, particularly in the induced captive breeding of seabass and supplying the seed to the various farmers also while providing the technology too.

Mr, K.S.Raja Deva Senapati, a progressive fish farmer who was supplied with the first crop of CIBA's seabass fish seed during 1997 narrated his experiences. He expressed his great satisfaction at the high rate of survival of the fish in culture conditions. In appreciation of his pioneering efforts and for being the first in achieving signal success, Director, CIBA presented the best fish farmer award to Mr.Senapati on the occasion. Dr.Subbarao, retired Principal Scientist of CIFE, Mumbai, presented certificates of merit to various fish farmers. Seabass seed produced at CIBA's hatchery was gifted to the farmers. Mr.Y.C.Thambi Samraj, Project Director,Rajiv Gandhi Centre of Aquaculture of MPEDA thanked the Director and the Scientists of CIBA for the help and assistance in successfully raising Seabass seed at their hatchery at Mayiladuthurai in Tamilnadu, under a consultancy programme. Dr. R. A. Sivakumar, Rtd. Asst.Director General Fisheries (ICAR), Mr.V.Venkatesan, Rtd.Director, MPEDA and Mr. Mathivannan, Principal, Tamilnadu Fisheries Staff Training Institute, offered falicitations. The fish farmers visited the various laboratories and hatcheries of CIBA.

GOA

Special Fish Farmers' Day was celebrated in Goa by organising a workshop which was held at the Fisheries Training Centre, Old Goa. It was inaugurated by the Director of Fisheries Mr. S.C. Verenkar who welcomed the farmers and highlighted the importance of the day and the need to culture fish so as to provide a cheap source of animal protein to the people, while also earning money. Lectures were delivered on the various aspect of culture, recent different techniques of culture and various species available for culture, and the economics of operation. The farmers' problems were also discussed and recommendations made to solve their problems. Two educational films on Breeding of Indian Major Carps (IMC) and Culture of IMC were shown to the participate. Later in the day, the participants were taken for a field visit to the Brackishwater Fish Farm at Ela Dauji. Practical demonstration of breeding of IMC and common camp was carried out at the Freshwater fish seed Hatchery at Keri Sattari Goa. There were 20 farmers who participated in the celebration. ☯☯☯

A.P. Fishing Boats resume Operations

The mechanised fishing boat operators in Andhra Pradesh resumed fishing operations from Sept 18, bringing to an end their month-long agitation. While the boat operators could not achieve the price they demanded for their shrimp catches from the exporters, they out of their own compulsions, they have resumed operations following assurances by the State Government regarding relief on sales tax on oil consumption.

After initially rejecting the prices offered by the exporters for various varieties of shrimps, the mechanised boat operators had to reconcile themselves to the rates arrived at a meeting with the district administration, the AP Commissioner for Fisheries and officials of a Marine Product Export Development Authority (MPEDA) early september.

Mr. P.C. Appa Rao, President of the AP Mechanised Boat Operators Welfare Association said that the State Government was processing the proposal for ST and Central Excise Duty relief . It is not yet known to what extent this relief will be given but it may possibly be Rs. 4.80 per litre, but one cannot be sure.

It will be recalled that fishermen in the mechanised sector along A.P. coast had gone on strike on August 16 demanding oil subsidy, reduction in berthing charges at the Visakhpaatnam Fishing Harbour, a mechanism for remunerative rates for their shrimp catches and ban on foreign trawlers in Indian EEZ. ☯☯☯

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Status of Indian Shrimp Aquaculture : Overview

Presentation of a overview of the current status of shrimp aquaculture in India, which is a complex activity, demands a brief narration of the status of its several interrelated components, to start with. Among these, the more important ones are related to area under culture and production therefrom.

Area

Annexure I provides an overview of the national and state-wise status of shrimp farming in India in respect of a) estimated potential area brought under shrimp culture and b) the annual levels of production achieved from 1990-91 to 2000-01. Reports indicate that the formal recording of culture shrimp production commenced in 1990-91.

National Position : Against an estimated area of 11,90,000 ha all along the coastline of India considered as suitable for shrimp culture, 1,41,837 ha are now under shrimp culture (ending 2000-01), as may be seen from Annexure I. The area covered by shrimp farms in the Coastal Regulation Zone (CRZ) along the entire coastline at the end of 2000-01 is at the same level as at the end of 1998-99, with a coverage of 11.91% of the total area available. In December 1996 the Supreme Court slapped a ban on setting up of new farms in the CRZ and allowed only such of the farmers in the zone following traditional culture practices (extensive/modified extensive) to continue the avocation. In order to ensure the implementation of the directive and as ordered by the Court, the Aquaculture Authority of India was set up by the Union Ministry of Environment and Forests, with headquarters in Chennai, under section 8(3) of the Environment (Protection) Act, 1986. While this Authority is now functional, a comprehensive legislation on the subject, the Aquaculture Authority Bill, taking into account aspects other than environment and at the same protecting it, has been recently lined up for introduction in the Parliament. This Bill covers powers and functions of the Authority, among others.

State-wise Position: Out of the total area of 1,41,837 ha under shrimp culture as at the end of 2000-01, looked at state-wise, the highest area under production is in A.P. (71,000 ha), followed by West Bengal (47,067 ha), Kerala (14, 705 ha), Orissa (8000 ha), Karnataka (3564 ha), Tamilnadu (1087 ha), Goa (650 ha), Maharashtra (426 ha), Gujarat (316 ha) and Pondicherry (22 ha). The ranking is shown (a to j) in Annexure II.

It will be seen from Annexure I that, while there had been no addition to area under shrimp culture after 1998-99, there has been an increase in production, which went up from 82,634 t in 1998-99 to 97,096 t at the end of 2000-01.

Production

Details of overall National and Statewise culture shrimp production are presented in Annexure I.

Overall National Production: As may be seen from Annexure I, the national production of culture shrimps as at the end of 2000-01was estimated at 97,096 t. According to reports the culture production during 2001 so far has either improved or at the same level and that disease incidence is less. But for the ban on setting up of new farms there would have been a further increase in culture shrimp production. A predominant percentage of present level of culture production is that of tiger shrimp (*P.monodon*), with some quantities contributed by white shrimp (*P.indicus*) and probably of banana shrimp (*P. merguensis*).

Until late 1980s shrimp production consisted mostly of capture component only. By 1990s the contribution of culture sector to overall shrimp production became noticeable, more so with the trend of zero growth or marginal drop in capture shrimp sector. Eventually, as at present, the culture shrimp segment has come to occupy around 50% of the total shrimp catches. It can be said that, culture shrimp production has become a saviour to maintain and enhance Indian shrimp exports levels.

There had been a steady rise in overall culture shrimp production from 35,500 t in 1990-91 to 82,850 t in 1994-95. Thereafter, there was a drop in production, only to increase to 82,634 t by 1998-99. An upward production trend set in thereafter reaching a level of 97,096 t by the end of 2000-01. This is attributed not only to the progressive increase in area from 65,100 ha in 1990-91 to 1,41,637 ha by 1998-99 (Annexure I) but also to improved culture practices. The production level however came down to 78,860 t in 1999-2000 owing to disease incidence. One point of interest is that the reported culture shrimp production level at the end of 1999-2000 was higher than the production as at the end of 1993-94, but coming closer to one lakh ton mark by 2000 - 01.

The overall increase in production, is contributed substantially by A.P. In this State, the area under production increased from 50,000 ha in 1995-96 to 71,000 ha in 1998-99, (Annexure I), despite the disease problem and reduction in stocking rates.

The highest overall production after 1990-91 was recorded in 1994-95. In this year, the production was 82,850 t obtained from 1,00,700 ha. The lowest overall level was at 35,500 t, taken from 65,100 ha in 1990-91, when the culture activity was in the very early stage. So far as per capita production is concerned, on a national basis, the highest average was achieved in 1994-95 (819 kg/ha), followed

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by 582 kg/ha in 1998-99 and moving upto 684 kg in 2000-01(Annexure II).

State-Wise Production: The particulars of state-wise production and average per hectare production upto 2000-01 are depicted in Annexures I & II. As may be seen therefrom, 53,100 t were produced in A.P. followed by West Bengal (21,079 t), Orissa (7360 t), Kerala (7,327 t), Tamilnadu (3792 t), Karnataka (2733 t) Goa (966 t), Gujarat (424 t) and Maharashtra (315 t).

So far as per hectare production is concerned, Tamilnadu ranked first at 3488 kg, followed by Goa (1486 kg), Gujarat (1342 kg), Orissa (920 kg), Karnataka 767 kg), A.P. (748 kg) Maharashtra (739 kg), Kerala (498 kg) and West Bengal (501 kg).

Farm Ponds

As in most other countries of south-east Asia, coastal aquaculture of India too had developed in a haphazard manner, resulting in shrimps under culture mostly becoming victims of disease attack. This affliction led to slower and wavering growth in culture shrimp production. It has also led to reduced stocking rates.

Pond Preparation: The traditional system of pond preparation, consisting of drying of pond bed, removing from the bottom the top soil layer impregnated with waste feeds etc and liming before turning in water has been improved over years. Several farmers now chlorinate the water taken in and undertake stocking with shrimp post-larvae after dechlorination. A few farmers have adopted the system of having reservoir ponds and chlorinating and dechlorinating the water in them before taking it into grow-out ponds. Over years, frequency of water exchange in shrimp ponds has come down.

Water: The dependence on sea water for farm water intake has come down drastically after 1994. A recent development is the use of freshwater/bore-well water for filling up ponds for culture of tiger shrimps. Being euyhaline and because of the conducive culture systems developed, tiger shrimps have been observed to thrive well in these media despite very low salinity levels or even with no trace of salinity. Another advantage noticed is that white spot virus is unable to attack shrimp in freshwater and bore-well water media with the same ease as in saline water media. So much so, white spot disease incidence is stated to be very low in freshwater/bore-well water filled ponds.

Aeration: With reduction in stocking rates, several farmers, particularly farmers holding small ponds, have given up using aerators.

Sourcing of PLs: Over the years, there has been a major shift from dependence on wild seed to hatchery produced post-larvae for stocking farm ponds. Prior to delivery, the post-larvae are subjected to stress and PCR tests at most of the hatcheries.

Post-larval Production for Stocking

Brooders: So far as white shrimp is concerned, no serious problem in respect of securing virus-free brooders is experienced. Domesticated brooders are available out of stocks grown in farms. These domesticated ones are generally free from virus.

In regard to tiger shrimps, the dependence in respect of securing brooders/gravids necessarily continues to be on those captured from the sea for want of an alternative. It is now established that brooders collected from the wild carry white spot virus, although in a dormant form and that they transmit the virus to post-larvae. As the post-larvae grow up, and particularly when they are weak, the virus surfaces at some stage of growth or other.

In some of the countries such as USA (Hawai) French Polynesia, New Caledonia and also recently in an Australia scientific organisation there has been success in raising domesticated gravid tiger shrimp for several generations, stated to be upto twelve, for supply to shrimp breeders. This success has enabled the shrimp breeders in these countries except Australia to supply to the farmers post-larvae of tiger shrimp free from white spot syndrome virus (WSSV). Until the problem is resolved through domestication of the species as in the countries referred to above, and disease-free domesticated tiger shrimp brooders become available to breeders/hatchery owners, Indian farmers have to reconcile themselves to stocking their farms with hatchery produced post-larvae raised from wild brooders, and continue to take the risk of their turning out positive to WSSV at any of the growth stages. There is, however, a ray of light. The scientists of CMFRI have succeeded in raising tiger shrimp upto F_4 generation and further work is in progress.

There has been so much of progress in the production of domestic tiger shrimp in some of the foreign countries that atleast one US company, High Health Aquaculture Inc., advertises for supplying domesticated tiger shrimp broodstock.

These is a general feeling among hatchery owners that, once our scientists are able to produce domesticated tiger shrimp brooders, the culture production scenario will vastly improve, as seed supplies from hatcheries will be disease free, produced under hygienic culture conditions.

Shrimp Hatcheries: There are 222 shrimp hatcheries along the coastline of the country with a production capacity of 1,07,000 lakh nos. (10,700 mill) of post larvae. Of these hatcheries, nearly 62% (137 nos.) are located in Andhra Pradesh accounting for 64% of the total national PL production capacity (68,500 lakh nos PL per annum). Next to Andhra Pradesh, Tamilnadu has 61 shrimp hatcheries with capacity to produce 30,500 lakhs of PL per annum.

The particulars are given in Table 1.

Dual purpose Hatcheries: The collection of tiger brooders from the sea is an arduous, risky, and expensive task. As availability of brooders is crucial to the hatcheries there is keen competition for the their purchase. This has the effect of pushing up the cost of a brooder to a level of Rs. 50,000 or even more sometimes. Brooders are harvested and supplied by a separate set of operators. Further, the detection of white spot virus at the hatcheries at larval or postlarval stages with certainty before delivery of PLs to farmers has become a major problem. Taking advantage of this predicament and to the relief of the hatchery owners, a few enterprises have set up nauplii production centres. Now most of the hatcheries depend for nauplii supplies on these centres instead of buying brooders and passing through the ordeal of ablating them and subjecting themselves to all the associated follow-up measures thereafter.

Feed for PLs: Artemia continues to be the main feed at the hatcheries for PL production. A few substitute products have come into the market but they could not replace Artemia. Taking advantage of this, the suppliers, tend to jack up prices when the product is at its peak demand or in short supply.

Pl pre-delivery precautions: In regard to PL pre-delivery precautions, most of the hatcheries now challenge the PLs with a stress test in 100 ppm formalin for 2 hours. Later salinity adjustment of water used for packing is also made to 5-7 ppt level or as the farmers wants and PLs are conditioned in this medium for about another two hours before final packing and despatch.

Table - 1: Shrimp Hatcheries

State	*No. of Hatcheries*	*Production Capacity per ha/yr/in nos. lakhs*
Andhra Pradesh	137	68500
Gujarat	1	500
Karnataka	12	6000
Maharashtra	2	1000
Orissa	9	500
Tamilnadu	61	30500
Total	222	107,000

PCR tests from nauplius stage onwards have also become common. A couple of hatcheries has set up their own PCR Labs.

Seed Vendors : A new category of professionals referred to as seed vendors have come into being, particularly in A.P. These vendors lift PLs from hatcheries in the off-season and rear them in small nurseries for a short duration. The early juveniles so reared are sold to farmers at higher prices. This system is followed by the farmers who have taken to shrimp culture in freshwater media too. In fact, one comes across sign boards on the road side in the coastal districts of A.P. to indicate that shrimp juveniles acclimatised to freshwater conditions are available for sale.

Inter-state and foreign supplies: Inter-state PL supplies have become common. Supplies are also made to neighbouring countries such as Bangladesh. These supplies are handled mostly by intermediaries. Road/air transport is used for carrying the consignments.

Culture in Freshwater: There is a conspicuous trend, particularly in Andhra Pradesh, to undertake tiger shrimp culture in freshwater ponds located in areas not only somewhat away from the CRZ but also within the CRZ. Freshwater or bore well water is used for this culture with success. The harvested shrimp are seen to be of good growth, with the majority of them or all of them free from white-spot disease. In fact, Dr. K. Gopakumar, Deputy Director General (Fisheries), ICAR advised the M.P. Government at a workshop held in Bhopal in Feb 2000 that Tiger Shrimp culture may be taken up in lentic waters of the States. A recommendation was also made by that workshop to this effect.

Stocking Density: A major development after 1994, the year in which WSSV struck, is that stocking densities in most of the ponds have come down to levels of around 5 nos/sqm, and with production levels hovering between 500 - 1342 kg per ha. Intensive systems have been totally given up. Semi-intensive system has also become rare.

Mangrove Plantation: The farmers depending on creeks for water intake have taken to planting of mangrove plants on the margins to improve water quality.

Aquaculture Clubs: A trend towards the formation of aquaculture clubs has set in. Several such clubs have been formed in West Godavari and Krishna districts of A.P. and probably in other coastal states for cooperative action in respect of water intake, water release etc.

Aquaculture Clinics: Aquaculture clinics have come up at several places, particularly in A.P. These clinics help their client farmers by undertaking regular sampling of water, checking of condition of shrimps under culture etc., and providing reports to the farmers suggesting remedial measures where necessary.

The needed infrastructure and organisational mechanism in the private sector to facilitate routine collection of data on various pond parameters and also for monitoring the developments in culture activities from time to time are being built up. There has been also progress in the setting up of a chain of laboratories at needed locations for extending professional help to the farmers and for the timely diagnosis of diseases that afflict shrimps and for undertaking remedial measures in the private sector too. MPEDA has set up quite a few laboratories already. Now efforts are on for creating such facilities in private sector too.

PCR tests for white spot disease detection: Experiences have shown that PCR test results are not always consistently reliable, stocks whose samples give negative results sometimes turning out to be WSSV positive. The size and representative nature of samples taken for testing is now in the process of standardisation

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Table - 2: Dual Purpose Hatcheries Tiger/Freshwater Prawn

State	*No.*	*Capicity/lakhs/*yr
A.P.	15	950
Kerala	7	1000
W.B.	3	1500
Total	**25**	**3450**

through trial and error. There is trend towards adding PCR Labs to hatcheries One such lab was recently inaugurated at the hatchery of Santir Aqua and another is added to hatchery of Nekkanti Sea foods.

Probiotics: The system of adding probiotics specific to pond waters is gradually gaining in popularity sometimes in combination with zeolite.

Feed Administration: There has been a remarkable rationalisation of feed adminstration. The preferred system is to dispense 1.5 - 2.00 kg of feed for every computed weight of one kg of shrimp. Several farmers are reported to have switched over to using floating thermocole trays for feed dipersal.

Diversification: Because of the disease problem in cultured tiger shrimps, several farmers have switched over to giant freshwater prawn culture in the same ponds meant for shrimp culture, reconciling themselves to some drop in income. Several farmers are on the alert to switch over to pearl oyster culture, seabass culture, mud crab culture etc., but lack of guidance and imperfections and constraints in the way of taking to these new diversified systems of culture impede them.

Environmental Safety Concerns

Shrimp culture development has all along been suffering from an undeserved criticism and attacks by the environmentalist lobby, particularly from some of the non-governmental organisations. Despite these blocks the activity progressed, mostly for the reason that it is not basically a threat to the environment. The main issues raised in this respect are related to a) pollution b) salinisation of adjacent paddy fields, c) obstruction to access of fishermen to reach seafront and d) inimical effects on mangrove vegetation.

The environmental 'terrorism' had its beginnings in 1990. The activity, unjustifiably referred to by that phrase, reached its crescendo in 1996. The announcement of the judgement by the Supreme Court in December 1996 on quite a few public interest litigations on the environmental effects of shrimp aquaculture, brought down the severity of the anti-shrimp culture movement. This was followed by the dawning of the relisation that coastal shrimp culture in an intensive form tended to invite disease and other management problems. Consequently and because of Supreme court's directive, farmers have taken either to extensive or modified extensive form of shrimp culture, with minimal use of antibiotics.

Education and Training

There has been an increasing awareness among the various institutions engaged in imparting education and training in fisheries that integrated shrimp aquaculture activities, particularly in respect of shrimp hatchery management and water management of shrimp ponds needs a prime place in the syllabus because of the economic importance of the activity. Yet, the kind of reform that is needed to develop specialised courses to generate manpower for the effective operation and management of shrimp hatcheries and shrimp/brackishwater ponds has not yet materialised in the country in any significant measure. The same can be said about the present position of fisheries education and training in respect of shrimp disease management.

Socio-Economics

The impact of development of commercial activities in respect of shrimp aquaculture along Indian coastline has been positively conspicuous both in respect of social as well as economic betterment of those involved in the activity. By and large, the success of entrepreneurship, particularly at small-scale level, has led to improvement in the standard of living of those engaged in the activity and to a higher status in social circles.

A large number of commercial enterprises have sprung up for providing supplies of requisites and also for rendering services. Several processing plants have come up in the belts with shrimp culture ponds, thereby generating economic upgradation to the people of the area. The activity has attracted visits by foreigners interested in imports of processed culture shrimp. This has the effect of giving a boost to hospitality industry (Hostels and tourism) in small towns close to the activity.

The negative aspects are that larger houses and big companies who established integrated activities consisting of hatcheries, farms and processing plants have not been able to function in an enduring manner. The result is that almost all of them are now out of this line, with the exception of a few who continue to operate components such as hatcheries, and processing plants. In any case all big companies have for all practical purposes given up shrimp culture activity, with some of them leasing out sections of farms to small entrepreneurs. Some of the companies have reported losses in total contrast to small-scale enterprises, who, as mentioned above, have been able to continue operations successfully, despite prevalence of disease.

Conclusion

The total area brought under shrimp culture is around 142,000 ha. The current level of PL requirements at 5 Pl/sqm would come to 71,000 lakhs nos. The current production capacity of the hatcheries (1,07,000 lakh nos. of PL) is thus excessive. It is therefore necessary to explore ways of utilising the surplus PL production. One way is to progressively extend the activity to the freshwater lentic waters in the interior areas of the coun-

ANNEXURE - I

State-wise details of Shrimp Farming in India

(A - Area under culture in ha; P - Estimated Production in MT; H - Per ha production in Kg)

State	Estimated Potential Area (ha)		Annual levels of Area brought under culture (ha)										
			1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-2001
West Bengal	4,05,000	A	33,815	33,918	34,050	34,150	34,400	34,660	42,605	42,525	42,067	42,067	42,067
		P	12,500	13,800	16,300	16,500	25,000	23,445	19,949	15,121	18,326	19,960	21,079
		H	369	407	472	483	726	676	457	356	435	474	501
Orissa	31,600	A	7,075	7,417	7,760	8,150	8,500	11,000	11,332	11,332	8,000	8,000	8,000
		P	4,100	3,800	4,300	3,300	4,800	6,000	6,805	5,000	6,000	3,170	7,360
		H	579	512	554	505	565	545	600	441	750	396	920
Andhra Pradesh	1,50,000	A	6,000	8,100	9,500	19,500	34,500	50,000	60,249	66,290	71,000	71,000	71,000
		P	7,350	9,700	12,800	26,000	34,000	27,140	30,577	34,075	44,856	41,860	53,100
		H	1,225	1,197	1,347	1,333	985	543	507	574	631	589	748
Tamilnadu	56,000	A	250	480	530	1,050	2,000	2,879	640	670	1,087	1,087	1,087
		P	450	700	1,100	2,000	3,000	1,092	1,129	1,197	1,820	2,900	3,792
		H	1,800	1,458	2,075	1,904	1,500	379	1,764	1,780	1,674	2668	3488
Pondicherry	800	A	-	-	-	-	-	37	22	22	22	-	-
		P	-	-	-	-	-	10	27	20	27	-	-
		H	-	-	-	-	-	270	1.227	909	1,227	-	-
Kerala	65,000	A	13,000	13,145	13,400	13,860	14,100	14,657	14,658	14,595	14,705	14,705	14,705
		P	8,925	9,500	9,750	11,500	12,000	9,000	8,225	7,290	7,660	6,700	7,327
		H	686	723	727	830	851	614	561	499	520	456	498
Karnataka	8,000	A	2,500	2,542	2,570	2,600	3,500	3,500	3,500	3,540	3.564	3,564	3,564
		P	1,000	1,100	1,150	1,500	2,500	2,050	2,300	2,640	2,690	2,800	2,733
		H	400	433	447	577	714	585	657	746	755	786	767
Goa	18,500	A	525	525	550	575	600	650	680	650	650	650	650
		P	245	300	350	400	450	550	580	590	590	840	966
		H	466	571	636	696	750	846	892	907	907	1,292	1,486
Maharashtra	80.000	A	1,800	1,869	1,980	2,180	2,400	716	929	970	426	426	426
		P	800	930	1,050	300	400	740	523	700	409	330	315
		H	444	498	530	137	166	1,033	563	722	960	775	739
Gujarat	3,76.000	A	125	231	360	475	700	884	997	997	316	316	316
		P	125	170	200	500	700	546	572	235	256	300	424
		H	100	736	555	1.052	1,000	618	574	236	810	949	1,342
	11,90,900	**A**	**65,100**	**68,227**	**70,700**	**82,540**	**1,00,700**	**1,18,983**	**1,35,582**	**1,41,591**	**1,41,837**	1,41,837	1,41,837
		P	**35,500**	**40,000**	**47,000**	**62,000**	**82,850**	**70,573**	**70,686**	**66,868**	**82,634**	78,860	97,096
		H	**545**	**586**	**664**	**751**	**819**	**593**	**521**	**472**	**582**	556	684

ANNEXURE - IIa

Ranking of Present status of state-wise shrimp aquaculture of India (2000-2001)
Relative standing of various producing states 2000-2001

Select Indicators	*Ranking of various producing States : 2000-2001*									
	W.B.	*Orissa*	*A.P.*	*T.nadu*	*Kerala*	*Karnataka*	*Goa*	*M.rashtra*	*Guj.*	*Pondy.*
Area Coverage (ha)	42067	8000	71000	1087	14705	3564	650	426	316	22
Production (t)	21079	7360	53100	3792	7327	2733	966	315	424	-
Rank among various States (Total production)	B	C	A	E	D	F	G	I	H	-
Production level	501	920	748	3488	498	767	1486	739	1342	-
(per hectare/kg)	H1	D1	F1	A1	J1	E1	B1	G1	C1	-

ANNEXURE II b

Overall production levels reached so far

	Highest	Lowest
Year	2000-01	1990-91
Area (ha)	1,41,837	65,100
Production (t)	97,096	35,500

Annual Production per ha

Highest	*Lowest*	*National Avg.*
1994-95	1997-98	2000-01
819 kg/ha	472 kg/ha	684 kg / ha

try, after taking up a pilot programme so as to identify the problems that may have to be encountered in implementing such a programme and to work out solutions.

Domestication of tiger shrimp upto the stage of growing them in confined waters to a stage of gravidity is of utmost urgency. Only through this step, stocks of disease-free brooders could be developed. In this context it is encouraging to know that the Visakhapatnam Regional Centre of the Central Marine Fisheries Research Institute has succeeded in raising broodstocks of tiger shrimp upto 4th generation. It can be hoped that in another 2 or 3 years of work the generation of broodstocks would be standardised by CMFRI and the technology transferred to professional breeding enterprises, to enable them to produce broodstocks for supply to hatchery owners.

(A Fishing Chimes Feature)

* * *

Measure to Control WSSV in Post-larvae of Shrimp

What works, what may work, and What will not work

The following actions are reported to work in the control WSSV: a) PCR screening of PL, b) Egg and nauplii washing, c)Intensive juvenile rearing, d) water reuse, e) Use of disinfected washed feed trays, f) Providing feeds of improved nutritive quality, and g) domestication.

The following measures may work but one cannot be sure: a) PCR screening of nauplii, b) PCR screening of broodstock, c) Direct stocking of PCR negative PL, d) Fine mesh screening, e) Broadcast feeding, f) Feed additives (vit C, glucans, etc.), and g) National regulation.

What will not work are the following: a) PCR screening of broodstock before spawning, b) Stocking unwashed nauplii, c) Direct stocking of PCR positive PL, d) Untreated water exchange, e) Extensive with no feed programmes, f) Miracle products, and g) Wild seed and wild broodstock in general and unregulated extensive culture.

Source: Paper entitled 'Disease Management Protocols and Semi-intensive Shrimp Farming in Euador' authored by Victoria Alday Graindorge, David R.W. Griffith, published in *Global Aquaculture Advocate*, April 2000 issue.

* * *

AP Aquafarmers, Problems

Consequent to the disaster that struck USA, there has been a setback to the aqua products exports to USA. This is having a serious effect on the farmers of Andhra Pradesh, it is reported. Exporters have temporarily suspended procurement of material from the farmers. This has prevented the farmers from harvesting their shrimp farms. While some of the farmers are in readiness to harvest their ponds, shortage of ice and power breakdowns in the area are stated to be preventing harvests. Owing to their own problems, it is stated that the exporters have also reduced the procurement prices, which is having a serious effect on farmers too. It is hoped that soon the suitation would improve.

* * *

Reflection on Certain Possible Gaps in Indian Shrimp Culture Practices

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"Devi Krupa", 7 Ocean View Layout, Pandurangapuram, Visakhapatnam - 530 003

Domesticated Tiger Shrimp Broodstock Development

Shrimp farming has developed over the past two decades, based initially on wild shrimp seed stocking and later through predominant dependence on postlarvae produced at hatcheries, utilising broodstock caught from the wild. There was little realisation all along, that dependence on wild stocks of brooders for producing seed or on wild seed collections would result in rampant disease problem, chiefly of WSSV. The persisting disease problem has now highlighted the need for disease-free domesticated lines of tiger shrimp, which is the most widely cultivated shrimp species. While countries like India, having natural distribution of the species, have been complacent for sometime but realised later the inimical implications of dependence of wild stocks for culture purposes, countries such as New Caledonia, USA (Hawai), Australia etc. have forged ahead in producing domesticated tiger shrimp broodstocks. The level of progress can be perceived from the fact that one American enterprise inserts an advertisement offering supplies of monodon in *Global Aquaculture Adovcate* , as reproduced alongside, from its February 2001 issue.

The countries which have adopted the domestication route may be proud of their achievement but are riddled by a flaw in respect of disease incidence. There is a growing realisation that the domestication process has to be devoid of the element of disease and continue as such from generation to generation in a sustainable way. In other words, the brooders have to Specific Pathogen Free (SPF). Efforts towards this have to be inbuilt into long term excercise taken up for the purpose, with emphasis on disease-free lines.

CMFRI has started the tiger shrimp domestication process and is stated to be now in the process of raising the fourth generation. It is possible that scientists of CMFRI are now working on the project probably using polychaetes (*Neries* spp) and squid flesh as feed for raising the brooders. In any case it is known that at quite a few centres abroad this feeding practice is followed. There is an unconfirmed information that part of the post-larval stock generated by CMFRI given to a private farmer for field trial had succumbed to WSSV in the grow-out stage, apparently due to non-adherence of the guidelines given for culture. This indicates the need for the Institute to set up a well-designed infrastructure of adequate extent, preferably in the form of an expanded closed water recirculating system to raise the captive domesticated seed stocks to broodstock stage. The investment involved for setting up such an infrastructure may be high but, looked at from any angle, it is certainly justified. One way of looking at this is that CMFRI can think of taking up a Joint Programme in association with the Fisheries Division of Ministry of Agriculture and MPEDA who can put in all the money needed, as it will pay dividend by way of higher incomes to farmers and stepping up exports. A foreign enterprise known to have a proven professional track record can also be involved in such a venture. The nation cannot afford to lose any more time in ushering in domesticated tiger shrimp broodstock regime and the sooner the on going project is strengthened the better it would be. Face to face with the grave and compulsive situation of the continuing dependence of hatcheries on wild broodstocks, most of whom are known to be infected with WSSV, one can be certain that the initiative of CMFRI would be strengthened soon in full measure.

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Domestication is the first step that must be taken to enable the farm and hatchery managers to produce disease free stocks. Further, the domesticated tiger shrimp broodstock development programme needs to be given the highest priority from another angle too. By having supplies of SPF broodstock, hatchery managers can reduce cost of seed production and farmers can produce tiger shrimp at a far lesser cost.

Upgraded Shrimp Culture Practices

Certain upgraded environment-friendly systems of sustainable shrimp culture have been gaining in importance in several countries but these have not yet made any significant entry into shrimp culture practices prevalent in Indian EEZ. The orders of the Supreme Court of India have restricted the operations to extensive/modified extensive systems and adoption of any other form of shrimp culture would amount to violation of the court order. Now that closed culture systems involving release of not more that 2% of the well-aerated water have come into vogue in several countries of the world with no adverse impact on environment, the Associations concerned should reurge the Supreme Court with all needed evidence to relax the order now in force to permit operation of closed water recirculation systems, which are proven to be environmentally friendly and pollution free, for shrimp culture.

Activated suspension ponds (Global Aquacuture Advocate April 2000 issue) are emerging as viable and environment - friendly media for sustainably optimised shrimp production. M/s Belize Aquaculture Ltd., in Central America and probably others too have adopted this activated system for producing healthy shrimps. At their farm, pond waters are continuously mixed and aerated, as an integral part of their routine operation. It may be mentioned here that this mixing and aeration are typical of most bio-technological production systems. In activated suspension ponds bio-technological systems are in operation leading to the formation of a dense microbial population, acting under optimal conditions. The process keeps the waters congenial and provide optimal and sustainable growing conditions for the shrimp and ensure feed recycling.

The water exchange being limited at zero to 2%, the water gets enriched in organic substrates. This, in addition to the optimal growth conditions, leads to the development of a dense microbial population (10^6-10^8 cells/ml), according to Prof. Yoram Avnimelech of Environmental Management Systems, Department of Agricultural Engineering Technian, Haifa, Israel. The Professor says in a paper entitled "Activated Suspension Ponds", published in *Global Aquaculture Advocate* (April 2000 issue) that activated microbial suspension is very efficient in the breakdown of organic waste materials and in nitrification. It is mentioned that only traces of ammonia are found in properly operated ponds, and nitrate comprises almost all the inorganic nitrogen (a lag period of about 3 weeks is needed to build up the nitrifying community).

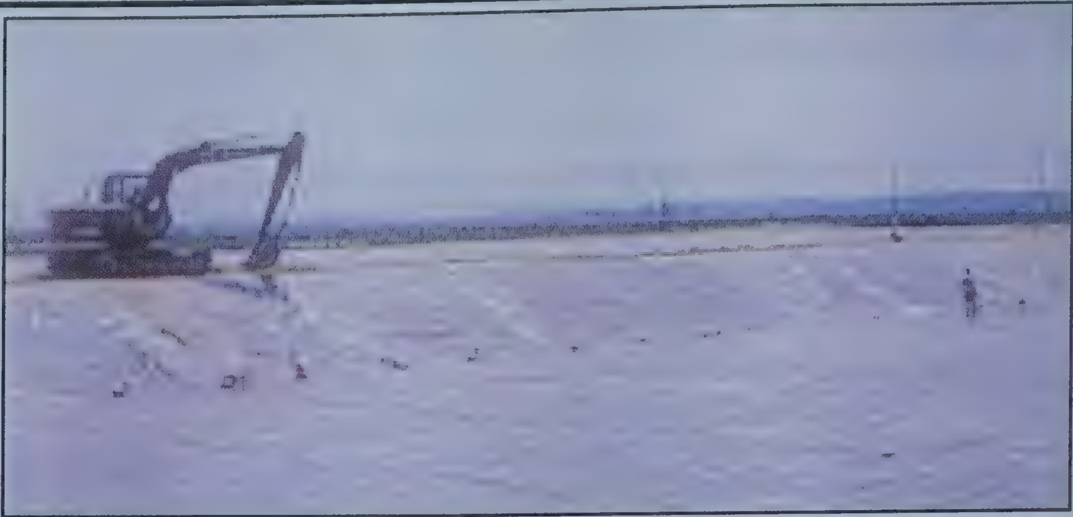


Fig 1. A pond lined with polyethylene sheet

It is stated that this technology is resulting in the doubling of protein utilization by fish and to a reduction, by about one-third of expenditure on feeding. The Professor explains that the fish eat the protein twice: first when they consume the feed and then when the left over is filtered out as microbial proteins. Similar improvements in protein conversion were found for penaeid shrimp in the farms ponds of Belize Aquaculture in Central America, it is said.

The production of microbial protein for feeds has been studied extensively, and the production of Single Cell Protein (SCP) from low-grade organic substrates is visualized as a source of feed protein to replace diminishing resources. In Activated Suspension Ponds, SCP is produced naturally but the day is not far away for the technology of concentrating the microbes and drying and packing them will be developed for supplying the same to farmers for feeding shrimps/fish, as the professor says.

Another observation of the professor is that animals grown in Activated Suspension Ponds have higher resistance against diseases, possibly due to the antagonism between the dense microbial population in the water against pathogens.

Pond Lining System

Indian aquafarmers have not yet taken to pond lining system. In USA and several other countries polyethylene sheets of needed length and breadth are used to line the bottom and sides of a pond securely so as to reduce a) operational costs, b) eliminate risks of disease, c) ensure hygienic water quality, d) adopt higher stocking rates, e) economise feed use and f) obtain optimum harvest results: The systems enables easier removal of left-over feed. It is desirable that the Central Institutes of Freshwater Aquaculture/ Brackishwater Aquaculture conduct ex

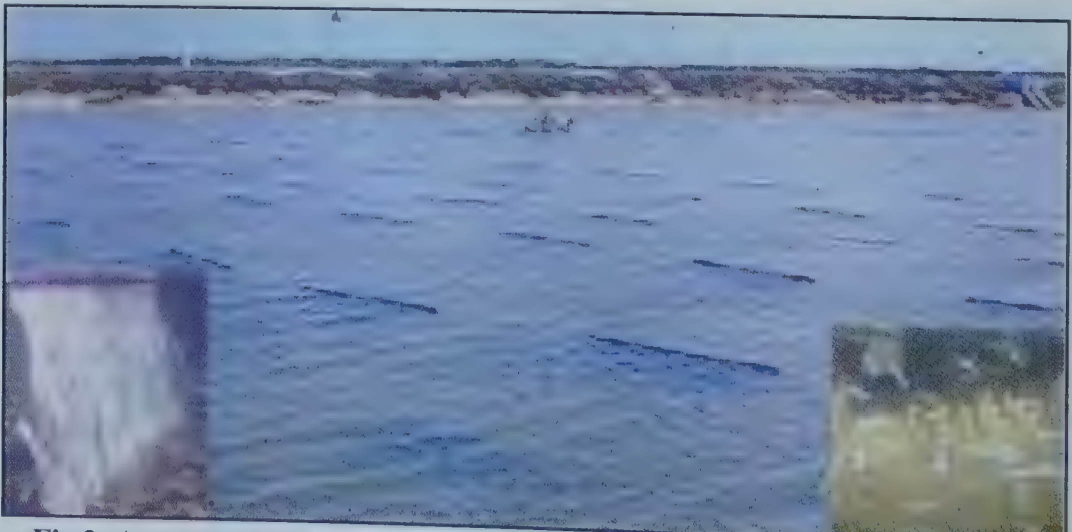


Fig 2: *Aqua Mat* System. Insets show the vertical and horizonal views of the related '*Aqua Mat*' configuration (Courtesy : *Global Aquaculture Advocate*)

periments and extend the technology as developed to the farmers. There are several firms in the country which would be able to produce and supply polyethylene sheets of required specifications. As their usage becomes popular, the cost of the sheets will come down and until it happens the fisheries departments/ MPEDA can subsidise this addition as that will increase production and also augment exports.

The astounding efficacy of pond lining system in boosting production has been described in a paper contributed by scientists of Texas Agricultural Experiment Station, Texas A&M University System, Port Aransas, Texas, USA and Agromarina de Panama S.A, Aguadulce, Panama, in Februrary 2001 issue of *Global Aquaculture Advocate*. The details are as follows.

Adjacent to 920 ha of existing earthen ponds at Agromarina de Panama's Aguadulce Farm, 18 lined nursery ponds and 18 lined growout ponds were constructed. Fences of staked polyethylene were placed around the perimeter to control entry of crabs.

Nursery Ponds: Rectangular nursery ponds measured 30x13m (.04 ha) with average depth of 1.5 m. They were equipped with dual central drains and lined with black, 30-mil (0.8 mm) high-density polyethylene liners. The drain used for animal transfer to growout ponds was 30.5-cm-diameter PVC. Aeration/circulation was provided 24 hours/day to ensure aspiration of surface air to the submerged motor and propeller. Zero water exchange was used, although rainfall provided periodic additions to the ponds.

Nurseries were stocked with PL_{40-60} held for approximately 45 days in raceways at another location to verify no disease expression prior to stocking. PL were stocked in nursery ponds at 274-371/m^2. Local 45%-protein crumble feed was distributed manually into the ponds four times daily. Growth was determined weekly by checking 30 to 50 individuals sampled by cast-netting from ponds.

A molasses-grain mixture was added to both nursery and growout ponds weekly to provide additional carbon substrate for bacteria. Two to three applications of a nitrogen-phosphorus fertilizer were made three days prior to stocking nursery ponds. In both nursery and growout ponds, organic sludge was removed weekly through the screened central drain by opening a valve outside the pond.

Growout Ponds: Growout ponds were 0.1 ha square, with screened, 30.5-cm central drains. Aeration was provided 24 h/day. The design criterion for scaling and positioning of aeration/circulation units in both nursery and growout ponds was 6.1-12.2 cm/sec water current within 2m of the perimeter and zero velocity around the central drain.

Juveniles were held in the nursery ponds for six to eight weeks prior to transfer to gravity drain into the growout ponds. Assuming 90% survival through the nursery ponds, stocking density of growout ponds at the time of transfer was 123-130/m^2. Feed (35% protein with 3.5% squid meal) was distributed manually four times daily, as in the nursery ponds. Two feed trays per pond were routinely monitored for consumption and corresponding feed rate adjustment.

When excessive phytoplankton blooms occurred, calcium hydroxide was added to cause rapid decline of the bloom. Alkalinity was maintained at 100-120 mg/l throughout the cycle with periodic additions of calcium carbonate.

Control Ponds: Eleven earthen extensive ponds, which served as controls for comparison with the new intensive ponds, were stocked with postlarvae. The PLs came from wild broodstock matured in captivity. Extensive ponds ranged in size from 2.2 ha to 20.2 ha. Post-larvae ranged from PL_{12} to PL_{19} at stocking. Stocking density ranged 2.7 to 4.3/m^2. Half of the ponds were unfed, and the other half were fed on a 20-25% protein pelleted diet.

Water Source: Seawater used for both the intensive and extensive ponds came from an estuary. For the extensive ponds, seawater was filtered to 285μ from the farm's water distribution canal.

For the new intensive ponds, seawater from the canal was pumped through a pressurized 25-μ mixed-media filter into a temporary holding pond, then directly to the culture ponds prior to stocking. No seawater was added to the intensive ponds throughout the nursery and growout culture, although periodic rainfall did occur. Likewise, in the extensive ponds, no water exchange was used after filling.

Water Quality: Dissolved oxygen was monitored every two hours, and pH, twice daily. Daily oxygen values ranged from 5-8 ppm, and never dropped below 4.5 ppm. Daily temperature range was 26-31° C. Weekly samples were taken for salinity, alkalinity, phosphorus, ammonia, nitrite, nitrate, and zooplankton and phytoplankton enumeration. Harvest was accomplished through central drains by gravity, with some assistance from workers.

Intensive *Vs.* Extensive Ponds: Results of the comparison between the pilot lined ponds and the conventional earthen ponds were dramatic. In the 12 lined ponds, average survival was 80% (range 62-93%), following 125 days of culture in nursery and growout ponds, while average survival was 8.7% (range 4-20.3%) after only 59 to 83 days of culture in the 11 concurrently operated extensive ponds.

Clinical signs of WSSV were not observed in the intensive ponds at any of the weekly sampling periods, while in the extensive ponds, all ponds experienced two to three episodes of WSSV die-off. An average of 23.6 kg/ha per crop was achieved in the earthen ponds, compared with an average 11,086 kg/ha in the intensive ponds.

It is unclear whether the higher survival in lined ponds was due to the use of nursed postlarvae, pond liners, finer filtration of water, perimeter crab barriers, or a combination of the above factors.

Domesticated *Vs.* Wild Broodstock: In the lined ponds, no difference in survival at harvest was observed between the domesticated PL source (six ponds) and the wild broodstock-derived PL (12 ponds). Both groups averaged 80% survival (range 70-94% in the domesticated PL ponds, 62-93% in the wild broodstock-derived PL ponds). However, average growth/week was 42.1% higher in the domesticated PL ponds for the entire period from nursery stocking to growout pond harvest.

This resulted in higher average harvested biomass per ha (13,241 kg/ha in the domesticated PL ponds versus 11,086 kg/ha in the wild broodstock-derived PL ponds), even though the rearing in wild brood PL stocked ponds ponds was extended, on average, 24 additional days. Additionally, shrimp harvested from the domesticated PL stocked ponds were uniform in size. Runt deformity syndrome, indicative of IHHN virus, was observed in all ponds stocked with wild broodstock-derived PL, although no mortality due to this condition was observed.

Results achieved in the earthen test ponds were consistent with the entire farm's recent production. During the 30 days prior to harvest of the intensive ponds, 462 ha of earthen ponds were harvested, with average survival of 8.34% and average production of 24.3 kg/ha.

Effect of Soil: An additional observation from the farm added evidence that pond soil condition affects WSSV incidence. Nine small earthen ponds (0.1 to 0.4 ha, mostly 0.2 ha) were stocked at around 8/m². In four ponds, bottoms were renovated prior to stocking. The upper layer of soil was actually removed from the ponds.

In these ponds, average survival was 78.5% (range 52-100%). In the other five small ponds, bottoms were untouched for the previous two to three growing cycles, except for drying between crops. In these ponds, average survival was only 42.4% (range 24-55%).

There was one additional variable in the bottom-scraped ponds. Calcium carbonate was added at a rate of 45 kg/ha biweekly. Nonetheless, alkalinity and pH measurements were not different between the two groups, suggesting that the calcium carbonate addition may not have been related to the survival differences observed. This comparison seems to indicate that a soil-borne source of WSSV could be a primary issue in management of this virus.

Nutrient Substrate

Sterling Scott of Meridian Aquatic Technology, a U.S-based aquatic technology company says in *Hatchery International* May/June 2001 issue that *AquaMats* a registered product of the company is designed to be placed as a substrate in hatchery, nursery and culture tanks. *AquaMats* are stated to provide higher surface area for the growth of natural nutritional inputs such as benthic algae, bacteria and zooplankters for grazing. *AquaMats* also act as a substrate for renewable periphyton food resource. In addition, the innovative substrate provides hiding places for shrimp, according to him.

In a profile of Meridian Aquaculture Technology (A founding member of Global Aquaculture Alliance), *Global Aquaculture Advocate* (April 2000 issue) says that *AquaMats* are highly engineered with 'Ultra Weave' Technology to provide hundreds of meters of effective surface area in every linear meter of the product. It is explained that surface area is vital to sustainable food production in aquatic ecosystems, in much the same way that terrestrial soils, plants and trees are vital to land based ecosystems. Surfaces of *AquaMats* are designed to encourage colonization by benthic algae, bacteria and zooplankton for diet supplementation rich in HUFAs, vitamins and micronutrients. The vertically-oriented surfaces also provide habitat to encourage columnar dispersal of the animals under culture, it is explained. Pointing out that the stress and cannibalism are significantly reduced because of *AquaMats*, it is observed that they function as *in situ* biofilters in support of closed cycle (or limited water exchange) operations, because the vast amount of bioactive surface area that is provided. This unique combination of benefits allows *AquaMats* to support the productivity that modern aquaculture demands in a sustainable and ecologically responsible manner, it is stated. *AquaMats* for Aquaculture use have high-surface-areas to serve as substrates engineered specifically for hatchery, nursery, growout and maturation applications for aquatic farming, it is claimed. The company supplies *AquaMats* of Surface Deployment Format (SDF) too. These provide a complex three dimensional structure throughout the column, it is mentioned. The company also supplies *AquaMats* of Bottom Deployment Format (BDF) which rest on the pond or tank benthos and extend upward through the water column (Fig 2).

Meridian has concentrated its primary commercial work in marine shrimp applications of *AquaMats*, because shrimp species benefit from *AquaMats* technology at virtually all stages of development and production. *AquaMats* are now available for commercial fish hatcheries to extend the same benefits to finfish production. Meridian Aquatic Technology can be contacted on the World Wide Web at www.aquamats.com or by email at info@aquamats.com.

Nursery Phase in Shrimp Culture

Intervention of nursery phase in shrimp culture has become popular in several countries, and India is one among them. Nursery phase is a common one in major carp culture in India and its adoption in shrimp culture is a welcome feature, as it has demonstrated that it improves survival. It is said that efficiency of nursery phase operations can be improved considerably by using *AquaMats* as substrates in nursery ponds. Sterling Scott of Meridian Aquatic Technology says in a write-up entitled "Innovation in shrimp culture" published in *Hatchery International: Shrimp Special* May-June 2001 issue that, to stimulate a more natural rearing environment, many hatcheries are taking steps to enhance surface area in the larval rearing tanks by adding *AquaMats*, which are designed to provide a high surface area and grass-like habitat throughout the tanks.

Nursery culture of shrimp to a one gram or even larger size is becoming very common worldwide, Sterling Scott observes. He adds that the limiting factors in nursery culture of penaeid shrimp are density and management of the animals during transportation to growout ponds or tanks. Substrate technology, provides a sound base in the nursery phase, for achieving adequate growth rates to stocked shrimp PLs even at high densities to support profitable growout operations in the culture phase, he explains.

The science behind surface area supplementation in culture tanks is very basic in nature for shrimp and for many fish species. Surfaces provide a substrate for growing natural food that is at the base of the aquatic food chain. Because bacteria and benthic algae are efficient consumers of ammonia and other nutrients, they enhance water quality. In this background, Sterling Scott says that surfaces like *AquaMats* are specifically engineered to support this basic biological community. The fronds also provide animals with relief in the form of resting places out of the current. This has the effect of reducing stress and cannibalism. Lastly, for grazing species, high surface area supplementation extended through the water column is an effective way to disperse the animals throughout the entire volume of the tank, which has a number of other benefits, the author points out.

"There have also been significant improvements made in transferring small shrimp to growout conditions, perhaps the most important of which is the use of gravity-fed nursery tanks positioned astride growout ponds that allow shrimp to be transferred directly to the ponds. This combines the advantages of the increased bio-security of tank culture for the postlarvae, with control over the timing of transfer, all without introducing mortalities and stress through handling operations," Scott tells.

Over 5000 ha of freshwater ponds in A.P over 50 km away from the coast have been brought under shrimp culture in the inland zone. There are several other countries which have succeeded in similar endeavour. The only difference is that in India we are slow in spreading the activity into the heartland of the country. In this background, government should consider taking immediate steps to spread the activity farther from the coast in relays, based on appropriate logistic planning for supply of seed from the hatcheries located along the coast to farther areas inland. Mounting of a pilot scheme will stimulate and motivate the private sector to take follow-up action after the pilot scheme. Culture of shrimps in inland areas, it is believed, will be outside the purview of the ban imposed by Supreme Court which is restricted to the Coastal Regulation Zone only.

Conclusion

Top priority may be given by CMFRI for the production of domsticated Specific Pathogen Free (SPF) Tiger Shrimp broodstocks. The present pace of work may be stepped up , by organising expanded infrastructual facilities with the help from MPEDA and Fisheries Division of Ministry of Agriculture for financial and other support. If need be, help from one of the foreign countries which has succeeded in tiger shrimp broodstock domestication programme could be availed of. Supreme Court can be approached to allow closed systems of culture in Activated Suspension Ponds involving recirculation, known to be practically free from environmental hazards, if necessary after demostraction at one of the research institutes (CIBA/CMFRI). The system of providing nutrient substrates (*Aquamats*) in hatcheries, nurseries and growout ponds can be introduced, as the system is beneficial, if necessary after demonstration work at CIBA/CMFRI.

Nursery phase in shrimp culture should be popularised. Successful shrimp farming in freshwater having been proved, efforts should be made to extend shrimp culture into inland areas in phases over a period of time.

Obituary

P.K.R. Panicker Leaves Mortal World

Mr. P.K.R.Panicker, former Deputy fisheries Commissioner, Gujarat State, passed away on 24th August 2001, at Baroda. Mr. Panicker has been ill for quite some time.

Born in 1924 at Mavelikara (Kerala), Mr. Panicker joined the former Saurashtra state as Fisheries Officer in 1951. He held many important positions in the fisheries departments of the then bilingual Bombay State and the present Gujarat State and retired in 1982 as the Deputy Commissioner of Fisheries, Inland Fisheries Research Station, Ukai (Surat District).

Mr. Panicker was responsible for initiating the reservoir fisheries development programme in Gujarat State. He is remembered as the founder of the reservoir fisheries research station at the Ukai Dam site in Surat Dist. He is survived by his wife and a daughter.

Fishing Chimes mourns the loss of a pioneer in the fisheries sector and conveys its condolences to the bereaved family.

World Tuna Development International offers to A.P 34 crore Tuna Project

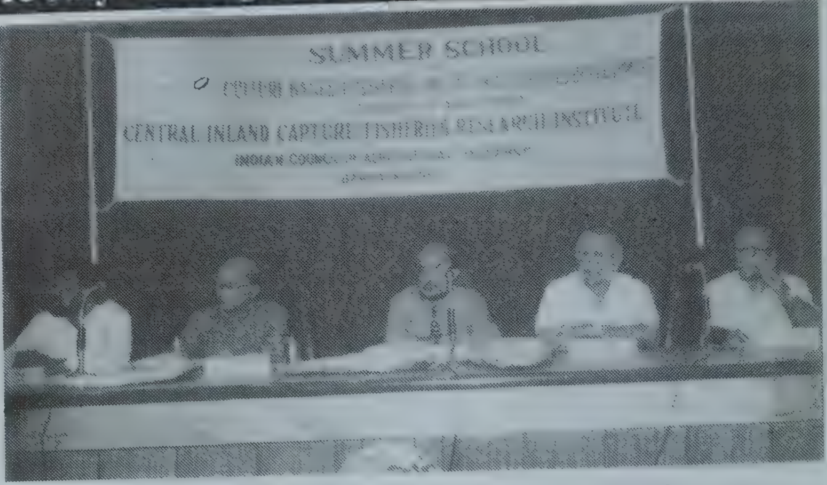
The Commissioner of Fisheries, Andhra Pradesh, Mr. D.S. Murthy said that the State Government was examining a proposal of the US-based World Tuna Development International with an outlay of 34 crores to take up an integrated tuna fishery project on the east coast of India. Preliminary examination of the report had shown that the project based on comprehensive data was extremely attractive and it had established that the investment could be earned back in a few years. He also mentioned that the project envisaged construction of twelve longliners and no flaw or disadvantage in the proposed project, could be located prima facie, it is stated. According to the proposal, the State Government has to invest only Rs.9 crores, while a matching equity contribution would be made by the World Tuna Development International. For any additional requirements the Exim bank would be approached. The Government is now engaged in obtaining views of experts, keeping in view the reasons which had prompted four Indian tuna private sector companies engaged in tuna fishing earlier to wind up operations, before approaching centre for such clearance as may be needed.

Summer School on Culture-based Fisheries Development

CICFRI, Barrackpore: 18 July - 17 August 2001

A Summer School on Culture-based Fisheries for inland fisheries development was conducted at the CICFRI, Barrackpore, from 18 July to 17 August 2001. Twenty five participants from various States representing Fisheries Departments, Universities, Agricultural Universities and Research Organizations took part in the Summer School programme.

The Summer School was inaugurated by Dr. S.A.H. Abidi, Member, Agriculture Scientists' Recruitment Board, New Delhi on 18 July 2001 at a function attended by Prof. A.K. Bhattacharya, Vice-Chancellor, West Bengal University of Animal and Fishery Sciences. During the inaugural function, Dr. V.V. Sugunan, Course Director, welcomed the participants and explained the background and relevance of the Summer School. In his inaugural address, Dr. Abidi emphasized the importance of sustainable fish production from inland water resources and its role in meeting the increasing demand for fish. He expressed the hope that the steps taken by CICFRI to disseminate the knowledge to the participating functionaries would bear fruit. The course included definitions and concepts of culture-based fisheries, its relevance in the Indian context and the scope of adopting it for fisheries development of the country.



Valedictory Session (From left to right) Dr. V.V. Sugunan, Director, CICFRI, Prof. D. Dasgupta, Vice Chancellor, Bidhan Chandra Krishi Viswavidyalaya, Dr. M. Sinha, former Director, CICFRI, Dr. P. Das, Former Director, NBFGR, Lucknow, Prof. N.C. Dutta, former Head, Zoology Department, Calcutta University.

Inaugural Session. Seen on the dais (left to right) Dr. V.V. Sugunan, Director, CICFRI, Prof. Ashim Kumar Bhattacharya, Vice Chancellor, West Bengal University of Animal and Fishery Science, Dr. S.A.H. Abidi, Member of Agricultural Scientist Recruitment Board.

Explaining that nearly 1.5 million ha of small reservoirs, 0.2 million ha of floodplain wetlands and many other small water bodies were amenable for practicing culture-based fisheries in the country, the participants were told that this system of culture would facilitate yield optimization on a sustainable and eco-friendly manner. Various methods of culture-based fisheries were explained to the participants. Lectures, laboratory work, field trips, dissertation and seminars were part of the course. Apart from the Faculty comprising the scientists of CICFRI, many experts from other organizations were also invited as Guest Faculty.

A practical class in progress.

A valedictory function was held on 17 August 2001 to mark the end of the Summer School. Certificates were distributed by Prof. Debabrata Dasgupta. Speaking on the occasion, Dr. V.V. Sugunan, Director of Central Inland Capture Fisheries Research Institute and the course coordinator expressed the hope that the themes developed at the Summer School would be further discussed and disseminated by the participants at their respective organizations. He assured all back-up assistance from CICFRI. Dr. M.Sinha, former Director, CIFRI, Barrackpore, Dr. P.Das, former Director, NBFGR, Lucknow and Prof. N.C. Datta, former Head of Zoology Department, Calcutta University, attended the valedictory session. Two participants, Dr. B.Santosh and Dr. V.R. Suresh were awarded certificates of merit for securing the highest marks in the tests conducted at the School. Dr. Suresh was adjudged as the best participant.

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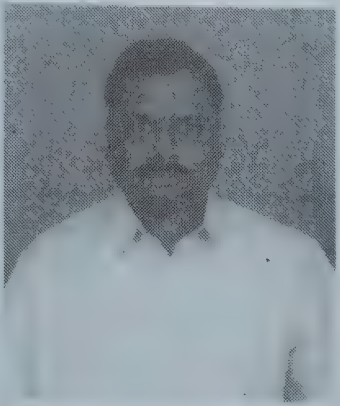
Status of Export Oriented Shrimp/Prawn Farming in Gujarat



K.R.Ramesh Babu
Asst. Director (AQUA)
MPEDA, RC(AQ.) VALSAD - 396 001.

Gujarat State has 1600 km long coastline. The topography of the coast is marked by salt marshes, sand belts and gravel patches.

The State has 13 coastal districts viz., Kachch, Rajkot, Jamnagar, Porbandar, Junagadh, Surendra Nagar, Amreli, Bhavnagar, Anand, Bharuch, Surat, Navsari and Valsad. It has about 3.76 lakh ha., of coastal fallow land, as per the report of the National Commission on Agriculture (1976). The State ranks second to West Bengal in the vastness of brackishwater area. Out of the total brackishwater area available coming to 3.76 lakh ha., the potential area is estimated at 1.87 lakh ha. Of this, 50,000 ha., is estimated to be available for immediate development.

Scope for Brackishwater Aquaculture

In view of the good scope for generating employment and income in rural areas through development of shrimp aquaculture, Gujarat Government has, as early in 1994, issued two orders (JMN.3993/3031-A dated 12.8.1994 and JMN/3986/2730-A dated 4.4.1987) laying down rules for allotment of brackishwater lands to weaker sections, individual enterpreneurs and others. Based on the above orders, Collectors of various districts started alloting lands to them. Apart from extending financial assistance, the Department of Fisheries, Govt. of Gujarat and the MPEDA's Regional Centre at Valsad were conducting training courses to the allottees of the lands regularly so that they could construct and manage the farms on scientific lines.

As in 1999 - 2000 an extent of 1080.65 ha. of coastal land has been brought under development. Out of this, an area of 380 ha., are presently under culture and shrimp production therefrom is estimated at 300 mt. Thus, it can been seen that brackishwater shrimp culture is somewhat of a low profile in Gujarat State. In this connection, it is worthwhile to point out that, in accordance with the directives of the Supreme Court, this activity has at present come to a standstill. There is no shrimp hatchery operating in the State except the one at Mithapur set up by Tatas and the State is dependent on the hatcheries situated in other States for meeting its seed requirement, as at present. The particulars of brackishwater development in Gujarat are furnished in Table I.

Table - 1 : Particulars of Brackishwater Development in Gujarat

1.	Length of coastline	1600km.
2.	Estimated Brackishwater Area	3.76 lakh ha.
3.	Estimated BW Area available for immediate development	50,000 ha.
4.	Total BW Area developed	1080.65 ha.
	a) With the encouragement of MPEDA	968.65 ha.
	b) Others	112.0 ha.
5.	Area presently under culture	380 ha.
6.	No. of farmers	135 nos.
7.	Estimated production annum	300 mt.

Gujarat accounts for an estimated production of 300 mt through brackishwater shrimp aquaculture and about 230 mt of scampi from village tanks/ponds/reservoirs. The exports are made from Mumbai port for the reason that the product is purchased by the Mumbai-based exporting companies.

The process of development came to halt with the allotment of land abruptly stopped in 1995 due to the Supreme Court's verdict on Aquaculture and its direction to constitute an Aquaculture Authority for issuing licenses to the shrimp farmers.

The National Level Aquaculture Authority constituted under orders of the Supreme Court has been functioning for the last few years. The State level and District level Authorities constituted by the Government of Gujarat have quickly screened the applications of the farmers and over 69 (325.5 ha.) farms have already been given licenses, and licenses for 66 cases (643.15 ha.) are pending with NAA. However, allotment of land for development of shrimp farming which was stopped in 1995 by District Collectors could not be revived as yet. The Government of Gujarat in expected to initiate action for speedy allotment of State-owned brackishwater land on lease basis to the prospective beneficiaries so as to provid thrust for augmenting shrimp production for exports - Table - II.

Freshwater Farming

There are 82 river systems passing through the State Out of these, Narmada, Tapati, Sabarmati and Banas are the most important. The total river length available to the State is estimated to be 3685 km., with an estuarine area of about 21,230 sq.km.

Ponds and Tanks: So far as Gujarat is con-

Table - 2
Land Allotment made for Brackishwater Farming in Gujarat (as on 30-4-1996)

Sl. No.	District	No. of Farmers Total	Small (5 ha.& below 5 ha.)	Big (Above 5 ha.)	Land alloted in ha. Total	Small	Big
1.	Valsad	170	154	16	1261	652	609
2.	Surat	96	96	-	221.5	221.5	-
3.	Bharuch	119	116	2	725	685	40
4.	Bhavnagar	10	10	-	46	46	-
5.	Amreli	7	7	-	33	33	-
6.	Junagadh	6	5	1	62	27	35
7.	Jamnagar	7	6	1	65	30	35
8.	Rajkot	3	3	-	15	15	-
9.	Kutch	45	45	-	225	225	-
	Total	**463**	**442** **(96%)**	**20** **(4%)**	**2653.5** **(73%)**	**1934.5** **(27%)**	**719**

Remarks Big Farms		
(1) Govt.		
i. GFCCA –	5	118 ha.
ii.GFDC -	2	202 ha.
iii.BFDA -	1	50 ha.
iv.Govt. Farm –	1	10 ha.
(2) Societies -	4	50 ha.
(3) Private companies -	7	219 ha.
Total	**20**	**719 ha.**

Table - 3 Production Trend of Freshwater Prawn

1.	Length of Rivers	3865 km.
2.	Area of Reservoirs	2.43 lakh ha.
3.	Area of village Tanks and ponds	71,000 ha.
4.	a) Total Area developed	126.96 ha.
	with encouragement of MPEDA	51.96 ha
	b) Others	75.0 ha.
5.	No. of farmers	16 nos.
6.	Estimated production from scientific culture	40 mt.annum
7.	Estimated production from ponds/tanks/reservoirs	230 mt.annum

cerned, the major thrust of the development in the inland sector is oriented towards fish culture in tanks and ponds and in respect of reservoir fisheries. Composite culture with Indian major carps (Catla, Rohu and Mirgal) and polyculture of Indian major carps and Giant Freshwater Prawn (*M. rosenbergii*) are the main culture activities in the region. Most of the village tanks are owned by the Revenue department which are leased out for fish culture activity for three years at a time. From these water bodies an estimated production of 230 mt of scampi per annum is estimated.

Freshwater Farming in Gujarat: Farmers of Gujarat State have been somewhat slow in evincing keen interest in freshwater prawn (*M. rosenbergii*) culture. In the recent past culture of this prawn is however picking up accounting for an area of 57.96 ha., under scientific farming with an estimated production of 40 mt. (Table -3).

Future scope of Freshwater Farming

Estuarine Systems of the rivers of Gujarat State have viable breeding grounds of Giant Freshwater Prawn *Macrobrachium rosenbergii*, which facilitate an abundance of availability of seed of this species from Sept - Dec. The Giant Freshwater Prawn is traditionally cultured along with fish. Being an exportable commodity with a growing demand, the farmers can receive upto ten times higher value for cultured prawn compared to fish. Realising the profitability of prawn farming, many farmers are opting for its culture. Though the concept of commercial farming of prawn is relatively new, it is catching up fast. Freshwater prawn farming can be taken up in almost all areas suitable for carp culture. However, prawn farming does require conducive farm construction and management effort. Since prawn species tolerate salinity upto 10 ppt., they can be cultured as an alternative cropping system during monsoon. Due to unpredictable production and high cost of seed, commercial farming ventures are lagging behind. The major constraint in the large scale development of aquaculture of giant prawn is the short supply of desired quantity of quality seed at appropriate time.

MFSc (Fishery Extension) Course at West Bengal University of AFS

The West Bengal University of Animal and Fishery Sciences has decided to start MFSc course in fishery extension in addition to the ongoing postgraduate courses. The decision is the result of joint efforts of Dr. P.Das, Consultant, Fishery Faculty of the University and Ex-Director, NBFGR, Professor A.K. Bhattacharya, Vice-chancellor, Professor K.C. Dora, Dean, Fishery Faculty and Dr. S.Dana, Head of the Department as Extension. It is stated that, at present such a course is there in the Fisheries College, Tuticorin in Tamil Nadu. It is believed that the commencement of the course will be the second one in the country and would help easing the demand for such qualified personnel in the country.

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TIPS FOR SUSTAINABLE SHRIMP CULTURE IN BRACKISHWATER PONDS

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The Tiger Shrimp culture industry of India has been experiencing erratic successes and failures particularly on the east coast. The erratic trend can however be converted into a continuously successful one by pursuing culture practices in such a way that the bacterial and viral infections could be avoided to a large extent thereby establishing sustainable and disease free culture conditions. Here are some tips for a sustainable and successful shrimp culture, based on the author's experiences.

Pond Preparation

Most of the farmers are in a hurry to complete pond preparation as fast as they can, overlooking several vital aspects. So much so, the bacterial loads in the ponds which get accumulated during earlier crops are not totally eliminated. In this context, the following suggestions deserve application.

* It should be ensured that the pond bed/ trench gets sun dried totally beforehand. Sun-drying is a very powerful natural disinfectant.

* The pond should be ploughed upto 10-15 cm depth during drying process to enable the subsurface soil to get oxidised. This is necessary to eliminate all the bacterial load.

* The pond bottom should be treated with burnt lime to stabilize the soil pH to maintain a healthy bottom for total culture period. In the case of soils where there is moisture which would not get dried even afer sun drying, they have to be treated with Zeolite at 100-200 kg/ha along with soil probiotics at 25-50 kg/ha.

Liming: Application of lime to pond bottom has to be undertaken in two stages. After the first ploughing, the first liming is to be done, followed by the second round of ploughing. Thereafter, before filling, second liming is to be done. This stabilises the soil pH of the pond bottom.

Soil Fertilization: In the case of ponds where there is problem of instability of plankton, inorganic fertilizers like urea and superphosphate along with dolamite at 100-200 kg/ha have to be applied before second ploughing which will help in the nutrient enrichment of water for the development of stable plankton bloom in the ponds, besides preventing algal crash during culture period.

Water Management

Water plays the most important role in shrimp culture.

During pumping into the ponds, water has to be filtered three times. By doing this, 90% of harmful ones can be eliminated. These will be in the form of fish eggs, developing stages of eggs, fry, and juveniles, besides several species of miscellaneous shrimp species, etc.

Chlorination: Calcium hypochlorite - Ca $(ocl)_2$ i.e., bleaching powder is commonly used for chlorination in shrimp culture. After complete filtration (3 times) the ponds have to be filled with that filtered water for 36-48 hours to eliminate predatory population. The ponds are to be chlorinated at 400-450 kg/ha of 1.0 - 1.2 m depth. Paddle wheel aerators can be used for complete chlorination of waters. The dechlorination starts after 24 hours of application of bleaching powder both naturally in sunlight and also by aeration. Chlorination kills the eggs and their developing stages.

Water Quality: After complete dechlorination of pond waters for 3 days, 150-200 kg/ha of dolamite has to be applied to eliminate the traces of chlorine.

The fertilization of the ponds thereafter at 15-20 kg/ha urea and 5-15 kg/ha of super phosphate will promote the phytoplankton bloom along with diatoms. Sometimes organic fertilizers i.e., dried chicken manure or cattle dung are also used for enhanced development of the water blooms. In case of delay in the development of plankton bloom, artificial plankton growth promoters (micro nutrients) at 3-10 kg/ha, according to the requirement,has to be applied. Sodium silicate at 5-15 kg/ha also can be applied for the developmeent of stable diatom population. Golden green colour of the water indicates the presence of 75-80% of diatoms along with 20-25% of green algae. Golden green colour is the best water colour (plankton density) to be on the look out before stocking seeds. Aeration of the ponds before stocking will enhance growth of phytoplankton including diatoms. At this stage the transparency of water will be at 25-35 cm which can be measured by seechi disc. At this stage the ponds are ready for stocking with the seeds.

Seed Selection

The main requirement for shrimp culture is seed selection, as quality of seed plays a major role in the success of the shrimp culture. The following are the most important points to be taken care of for seed selection.

i) Seed should be atleast in between PL 15-22 stage. Stocking in this range will optimise survival.

ii) The transparency and pigmentation of seed is an indicator of regular moulting and state of health. Hence these qualities have to be examined specifically while selecting seed.

iii) The muscle-gut ratio of the post-larvae should be 4:1, and the gut should be full of feed.

iv) Seed should not have any external fouling caused by protozoan, algal or fungal infections, which can be observed under microscope.

v) The seed should be exposed to stress tests like formalin test (100-200 ppm), change of salinity test, change of pH test and also 'movement against water current' test.

vi) Seed should be free from appendage loss; and

vii) The total vibrio bacterial count should be checked for optimum range. The seed should be free of MBV/WSSV and SEMBV, which can be checked at laboratories.

Seed Stocking

After selection of seed they can be packed and the packages transported to the site for stocking either in nurseries prior to transfer to growout ponds or to growouts straight away as decided. If the salinity, pH, temperature difference are the same as in the stocking ponds, the stocking can be done by acclimatizing the seed for 30 ppt. If there is variation in the parameters of seed and pond waters there will be need to acclimatize till the parameters get matched. For every 2 ppt of salinity acclimatisation will become necessary for atleast 10-15 mts. By following all these procedures the stocking of the seed can be completed. The most ideal time of stocking is late evenings (after 6 pm) in winter and early morning in summer (5-8 am.).

Hapas should be used to find the rate of survival of the seeds daily in the ponds after stocking. Hapas may be stocked with 200-300 pieces of seed and they can be counted after 24 hrs once and later after 48-72 hrs. This procedure provides information on the survival of the seed stocked. If the water colour in the growout ponds is good i.e., golden green colour, the survival of seed will be maximum.

Pond Fishery Management

During the crop period, water quality management is very important for the healthy growth of shrimps. The water colour should be monitored in a way as to avoid lab lab formation. Regular usage of dolamite at the rate of 75-100 kg/ha will help in the maintenance of good water colour.

For regular maintenance of the quality of water, liming with burnt and agriculture lime is preferred at the rate of 100-150 kg/ha/week in equal ratio. Water probiotics can be used periodically to prevent the increase of pathogenic baterial loads. The regular check on water quality will indicate the presence of traces of vibriosis, which can be treated with iodine, formalin and other water sanitizers. Regular prophylactic treatment of pond waters with 1 - 20% or 1 - 10% of these will not allow the bacterial loads to increase. Even BKC, formalin and other water sanitizers can be used to maintain good water quality in culture ponds. Overfeeding, unwanted treatments in ponds also will influence the change of water quality negatively.

Water Exchange: It is essential to exchange pond waters according to quality during culture period. In the early days of culture i.e., upto 10-15 g weight of each PL upto 60-70 days, the original load will be very low at the pond bottom due to low feeding rate. However, there has to be a continuous observation of extent of accumulation of organic load on a continuing basis without any complecency during this phase too, so as to guard against any undesirable developments. After 15-30 g stage, because of increase in the feeding rate, deposition of unconsumed feed and faecal matter goes up. During this phase, it is advisable to resort to water exchange at 20-30% level. At the low water level phase, in the process of water exchange, application of zeolite and soil probiotics will improve the soil condition and create healthy environment. By observing regularly the pond bottom condition, need for water exchange can be decided upon at the required time. It is not desirable to exchange water during moulting time, as it would create stress to the shrimps, and this may have an adverse affect. In other words, the need is totally dependent on the actual condition of the pond bottom. To avoid frequent exchange soil and water probiotics have to be used along with zeolite. All these will oxidize the pond bottom and prevent the formation of the toxic gases like H_2S, Ammonia etc.

Where stocking densities will be more as in semi intensive culture, the need for water exchange will be more and in modified extensive culture it will be less. In extensive culture it is almost nil, provided the pond bottom is healthily managed.

Feeding and Feed Management

Feed plays a major role in shrimp culture. In the early days after stocking of seed, feeding has to be done from day one itself. The feeding for the first thirty days is dependent on survival in hapas and regular observation of feed consumption in check trays and of movement of seed in the ponds.

Generally 1-1.5 kg of feed for one lakh stocking density is given on day one and it is recommended that the feed quantity be increased by 400-600 g per day for the same density till 30 days. Feed rate then on can be calculated depending upon the survival rate and average body weight. Feed consumption can be very regularly observed in check trays and depending on this, feeding rate can be adjusted at regular intervals. The body weight of the shrimps can be measured once every 7-10 days by sampling the shrimps. Rational feeding rate can be calculated by regular sampling and observing survival rate closely. If the feeding is correct and perfect, pond and water management will be convenient because there will not be much of deposit of unconsumed feed in the bottom. Overfeeding leads to accumulated unconsumed feed which leads to increase of toxic gases like H_2S, Ammonia, Nitrate etc., which are very injurious to shrimp health. Overfeeding also affects the water quality badly and the investment costs will go up after the harvest of the ponds. Surface of bottom soil becomes blackish. Underfeeding may lead to abnormal size variations, pronounced cannibalism, low survival rate, soft shell formation in smaller shrimps due to malnutrition etc. Therefore, feeding should be planned and executed very carefully in shrimp culture.

Health Management

Shrimp will have healthy growth only when hygienic conditions of ponds are properly maintained. Health management is nothing but keeping the pond bottom clean and free of unconsumed feeds, decaying organic matter, dead plankton and toxic gases like H_2S, ammonia, nitrite etc. If the feeding rate is well regulated, pond bottom will not have unconsumed feed accumulations and this keeps the water quality good. If any change in water conditions or behaviour of shrimps is observed, the pond bottom has to be checked immediately and as needed. Oxidation of soil by application of "Zeolite", soil probiotics and water exchange has to be undertaken. By regular application of soil probiotics the pond bottom can be maintained very healthy. The farmer/ farm manager has to be always on the alert about any symptoms of algal crash. This can be of course be avoided by maintaining water quality. If all the water parameters like pH, salinity, dissolved oxygen, alkalinity, plankton density etc., are maintained consistently at optimum level, water quality will be good.

Disease Management

Any change in bottom conditions and water quality will alter environmental conditions and this change will tend to adversely affect the health of shrimps through diseases which may be bacterial, viral, protozoan, fungal or algal in nature. Apart from this, there are diseases caused by change of parameters (environmental) and also nutritional deficiency.

Of all diseases, white spot viral disease has become a major menace, as attack by this virus is mostly due its inheritance from the mother. It lies dormant in healthy water conditions and becomes active when conditions deteriorate. The attack can also take place because of contamination from nearby farms, dropping of infected shrimps by birds into the ponds etc. Through careful selection of PCR-negative seed, maintaining good water quality by chlorination of intake water and by avoiding cross contamination, viral infections can be prevented to a large extent. Detection of viral infection in shrimp can sometimes mean that the root cause is either bacterial, protozoal or fungal infections which can be observed at early stages and can be prevented, so that they may not lead to viral infection. If the viral infection is carried through mother to the seed, there is every possibility of outbreak of viral disease during any stage of culture period, particularly when the shrimp undergoes stress either during moulting time or when unfavourable conditions like cloudy and rainy weather, or very high / low temperatures prevail. The need is therefore to see that shrimps are not exposed to high stress. Other diseases like bacterial, fungal, algal and protozoan can be observed at a very early stage and they can be cured by proper treatment within few days of their appearance.

The nutritional deficiency diseases can be prevented by using good quality feed and also by using feed probiotics, immunostimulants, micro-nutrients and digestive enzymes.

The diseases caused by change of environment i.e., exposure of shrimp to very high / low temperature, sudden change of salinity / pH of water etc., can be prevented by maintaining good water level / good quality of water and also keeping water parameters at optimum level.

To sum up, the following steps are suggested for healthy management of shrimp culture and harvesting optimal crops consistent with stocking level, and good profits.

1. Careful and perfect preparation of pond bottom by application of lime / Zeolite / soil fertilizeers /soil probiotics.
2. Pumping perfectly filtered and chlorinated water free of predatory population to the culture ponds and maintain the best plankton densities.
3. Regular monitoring, maintaining and management of healthy pond bottom and water quality.
4. Usage of best quality feed and regular application of feed probiotics, digestive enzymes, immunostimulants and vitamins.
5. Periodic application of water probiotics and water sanitizers to maintain the ultimate water quality and maximum aeration of water (in highstocking densities).
6. Good water level (1.2 - 1.5 m) and good plankton density will provide the best environmeent to shrimps.
7. Regular monitoring and observation of feeding will prevent the under / over feeding.
8. Observing the shrimp health with asistnce of a technically qualified expert will prevent the occurrence of diseases.

* * *

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* * *

Possibilities and Options for Conservation of Shrimp Resources of Upper East Coast of India

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General depletion of marine fish and other aquatic stocks has become a global phenomenon. So much so, the present need is more for sustained exploitation of resources, tempered by apt conservation measures.

Shrimp are one of the most valuable fishery resources of the world. They command a sizeable demand particularly in the markets of richer countries (U.S, Japan and countries of Europe). The producing countries enjoy several state incentives to support shrimp output as a means for augmenting exports. In this context, this paper deals with objectives and approaches in respect of shrimp fisheries of Upper east coast of India and the management issues involved.

Bottom trawling and gillnetting by vessels of various LOA from 7m-28m for exploiting shrimp stocks all along the east coast of India developed in different contexts. So far as upper east coast is concerned, the annual penaeid shrimp landings increased from 11,177 t in 1980 to 25,191 t in 1995 and declined to 23,364 t by 1994 (Sudhakara Rao and Varma, 1999). So also is gill netting, mostly with trammel nets. In all the regions of the coast from West Bengal to South Tamil Nadu the important issues generated as a result of fishing intensity are economic overfishing and conflicts.

The high prices for shrimp for export markets have stimulated rapid development leading in many cases to excessive effort (Rajeswari *et al* 1999), even with regulatory measures, which have generally been unable to prevent overcapitalization, excessive production cost, low or even negative economic returns to the country and perhaps an overall reduction in total catch value. The value and strong demand have often led to an uncontrolled increase in shrimp fishing efforts (Upper east coast - 70 large trawlers, 800 Sona boats, and 25 mini trawlers are operating) to the point where the economic situation of fishery has became very critical per unit, income plummeting to a very uneconomic level. Some fishermen no longer are able to cover their capital costs and sometimes even their operational costs. Governments intervene by providing subsidies to cover operational costs (subsidy on diesel oil, high sea bunkering) and so on, but these aggravate the situation, leading possibly to overall economic losses to the country. Further, despite some relief, the fuel costs continue to be high and add to problem of economic losses. Shrimp fisheries survive by the fact the marginal yield from this fishery is still higher than other potential alternative fisheries because of relatively higher returns due to export potential, the result of economic overfishing (Garcia, 1989).

Shrimps are very fast growing animals. Intensive exploitation of shrimps starts in their early life stages itself leading to growth overfishing. By avoiding growth over fishing i.e., through optimization of yield per recruit, greater gains in weight and value from the survivors could be achieved. One of the key issues in present day shrimp fishery management with reference to a given shrimp market is related to appropriate age at first capture and the fishing pattern to reach a specific economic objective.

Due to increased exploitation of capture shrimp resources and culture shrimp development in brackishwater environment, conspicuous imbalance between shrimp and finfish exploitation on one hand and between shrimp hatcheries and those catching wild post larval shrimp resources for supply to farmers on the other has come about. In fact, shrimp fisheries are the major cause of the biological and socio-economic problems along the East Coast of India and similar situations are known to exist in other tropical zones too.

The shrimp culture sector has emerged in recent years as one of greater potential for augmenting shrimp exports compared to the capture sector, which has lost its primacy. Further, within the capture sector there are serious conflicts and competition between small mechanized boats and larger ones in the harvesting of shrimp and finfish resources. Further, small scale fishermen complain about destruction of their gear by larger trawlers, and about these trawlers landing large quantities of shrimp to their disadvantage. Growth overfishing of shrimp has reduced post-larval recruitment and this has led to the overall decrease of the capture shrimp stocks, generating concern.

Year to year variability in quantity of exploited shrimp fisheries prevails, because shrimps constitute one year class. Those that attain a little over 12-months of age, if not captured, are believed to die of old age. The annual yield thus depends on the annual level of recruitment which is widely influenced by environmental conditions. This situation complicates efforts at modeling to estimate the maximum sustainable yield and determination of annual catch quotas, formulation of management strategy aimed at monitoring of fishing effort to conform with exploitation to the level of annual quotas.

Bay of Bengal is the home of several species of shrimp with varying population and distribution levels in space and time (Sudhakara Rao and Varma, 1999). Shrimps are exploited generally round the year. A closed season for shrimp is however declared from 15 April to 30 May but this is not effective, shrimp being an annual crop. An additional reason for the ineffectiveness is that during this closed season, foreign trawlers are known to take advantage of the total absence of fishing activity by Indian vessels, and exploit the resources, with Indian boats as helpless spectators. Coastguard is expected to apprehend intruders but the general talk is that this does not generally happen. So far as finfish is concerned, management of this fishery becomes difficult because of large quantities of bycatch of lower economic value, landed by larger vessels. Further, this component competes in the market with fish landed by small-scale boats. The biological problem is to know what effect sweeping of the food material at the bottom, consequent to the operation of small meshed demersal nets, will have on shrimp production, as this may reduce feed availability to shrimp stocks.

Management Issues

The fishery sector is a complex entity comprising many groups with conflicting objectives. These groups include boat owners, processors, retailers, consumers, politicians, scientists, administrators etc. Reconciliation of the conflicting objectives of so many groups by themselves or with the help of an organization is an uphill task and this comes in the way of successful management. In this situation, it appears that the following have to be taken care of:

1. Prevention of irreversible changes of shrimp/finfish stocks and of fishing activities, and transgression of traditional principles and avoiding conflicts among different groups.
2. Maximisation of sustainable yields, ensuring equitable distribution of benefits (favouring small scale activities), employment, improving working conditions of fishermen and acquisition of data for forecasting future fishing outlook, ensuring acceptability of regulations by fishermen, and keeping track of cost effectiveness of regulation and control (Gracia, 1989)
3. Work towards bringing down subsidies, discouraging efforts at fishing of undersized groups, reducing adverse ecological impact of fishing activities, and preventing political parties from unduly interfering in professional fishing activities.

Shrimp fisheries management of upper east coast is largely oriented towards conservation and harvesting so as to maximize the yield. Unfortunately the present level of exploitation is far above the maximum sustainable yield (Sudhakara Rao & Varma, 1999). Considering this, the management strategies have to be oriented towards sustainable exploitation of shrimp resources with a view to ensuring that growth overfishing does not occur and adequate stocks of shrimps survive.

Management Strategies and Techniques

For the conservation and management of shrimp fisheries, strategies and techniques based on a mixture of regulation of catch, age composition, and regulation of fishing effort are needed.

It is desirable to regulate minimum landing size of shrimp. This can be indirectly enforced by banning export of small sized or undersized shrimp. A regulation of this kind is likely to arrest the on-going trend of progressive fall in sizes year after year. The catch per boat/trawler and catch per hour (kg) has been decreasing from 1997-98 (Sudhakara Rao and Varma, 1999) and the sizes of shrimp came down from U/5 to 140 count or even less fetching lesser price (Venkateswarlu, 1999).

Shrimp are fast growing and highly fecund. Most of them reproduce twice or thrice in a year with a peak in March to May (Joshua, 1992), when temperatures are high and favourable conditions for survival of larval stages exist. Exploitation of shrimps start from post-larval stages at mouths of estuaries and backwaters as wild seed for aquaculture. Their exploitation for food with traditional fishing nets from estuaries and coastal waters begins when they are two to three month old. As they grow further and are eight to over 12 months old they become targets for exploitation not only by small mechanised boats but also by larger freezer trawlers which operate in offshore zone at 40 to 60m depth. The catches include live brooders which are sold to shrimp hatcheries/nauplii production centres.

It is stated that observance of closed season for shrimp fishing over several years has not resulted in any increase in shrimp catch output in the Gulf of Mexico. Same has been the general experience along the upper east coast of India. It is therefore desirable not to rely on closed season for securing better shrimp outputs. Yet one can equivocate in favour of a closed season as it may provide enhanced breeding opportunities for shrimp, notwithstanding problems of enforcement. In any case, declaration of closed season need not be based on a fixed schedule but it can be related to their known migration pattern. In general, migratory movement of shrimp follows lunar cycle and it is maximum at new moon and full moon time. Bowen and Hancock (1985) refer to moon closure. In western Australia fishing is periodically closed for 10 nights around full moon time in order to prevent harvesting of a significant portion of soft newly moulted shrimps and to reduce intensive effort.

Fishing mortality can be reduced either by downgrading and controlling the capabilities of each vessel (vessel power and gear design, fishing time, bycatch quotas, moon closures, weekend closures, seasonal closures etc.,) or by reducing, the number of boats allowed to exploit the fishery. Such regulations to monitor total fishing effort would be difficult to enforce because they necessitate an effective control on landings, which requires lot of organisational/monitoring/supervisory effort. This may be difficult to institute, as regulations would create to the fishermen social and economic hardships. What can probably be attempted is to condemn and put out of use old boats and prevent their replacement. This will have the effect of reducing fishing effort and improving the economics of operation of remaining vessels.

Keeping aside the issue of closed season, scientists of related research institutes have to develop a model that would enable assessment of likely stock of shrimp that will be available for exploitation in any particular season. A model can be developed by taking into account the estimated degree of breeding success, worked out from sampling of population of post-larvae in the estuaries, backwaters, and nearshore waters.

Once the quantity that can be exploited is estimated, quotas for exploitation by vessels of each category can be fixed by a committee to be set up by the concerned research institute, with the participation of the representatives of the Associations concerned. There can be corrections to the quotas midway of the season.

Another management measure to be enforced is to totally prevent exploitation of post-larvae from backwaters, estuaries, creeks and other nursery grounds through appropriate measures to be enforced with the co-operation of fisher community. Shrimp post-larvae from the wild are mostly exploited for supply to farmers. Once post-larvae produced at hatcheries are within easy reach of farmers and conditions that dissuade farmers from buying wild seed prevail, the trade in wild post-larvae can be expected to have a natural death.

Like-wise, in a phased manner, the exploitation of gravids from the wild should be banned and this step should be synchronised with the development of domesticated broodstock. Until the production of domesticated broodstock picks up, it has to be stipulated that the hatcheries that receive wild broodstock supplies should release into the estuaries/backwaters nearby certain stipulated quantity of post-larvae. A mechanism to enforce the programme, to be worked out in detail, has to be developed.

Management techniques of post-larval habitat protection or conservation in nursery areas are more likely lead to successful results. It has been shown that the potential of a shrimp resource is proportional to the amount of habitat available in the nursery grounds (Turner, 1989). Identified nursery grounds must be protected from pollution, deforestation, land reclamation, dam construction and housing development.

Outright policies for conservation cannot succeed in a populous country like India. One saving grace is that shrimp fisheries are sustained by occasional massive recruitment but this is erratic and it is difficult to develop a model to predict any impending mass recruitment, unless there is a continuous assessment of parameters whose complex biological inter-relations are presently difficult to fully comprehend.

The interest groups which may influence fisheries management include producers, processors, consumers, tax payers and environmentalists. In the past, the interests of producers have often been treated as paramount, but , of late the last group has been receiving increased attention all over the world. This is understandable but can be made compatible with developmental efforts aimed at socio-economic development of fisherfolk, by protecting nursery grounds of shrimp, preventing live brood shrimp exploitation, development of programmes for disease-free domesticated tiger shrimp broodstock production, preventing exploitation of wild tiger shrimp post-larvae, encouraging disease free post-larval production from hatcheries for supply to farmers and also for one-time release of PLs by hatchery owners into natural nursery grounds. Closed seasons based on lunar cycles, and mesh regulations can be introduced, with follow-up measures to encourage fishing vessels to follow them.

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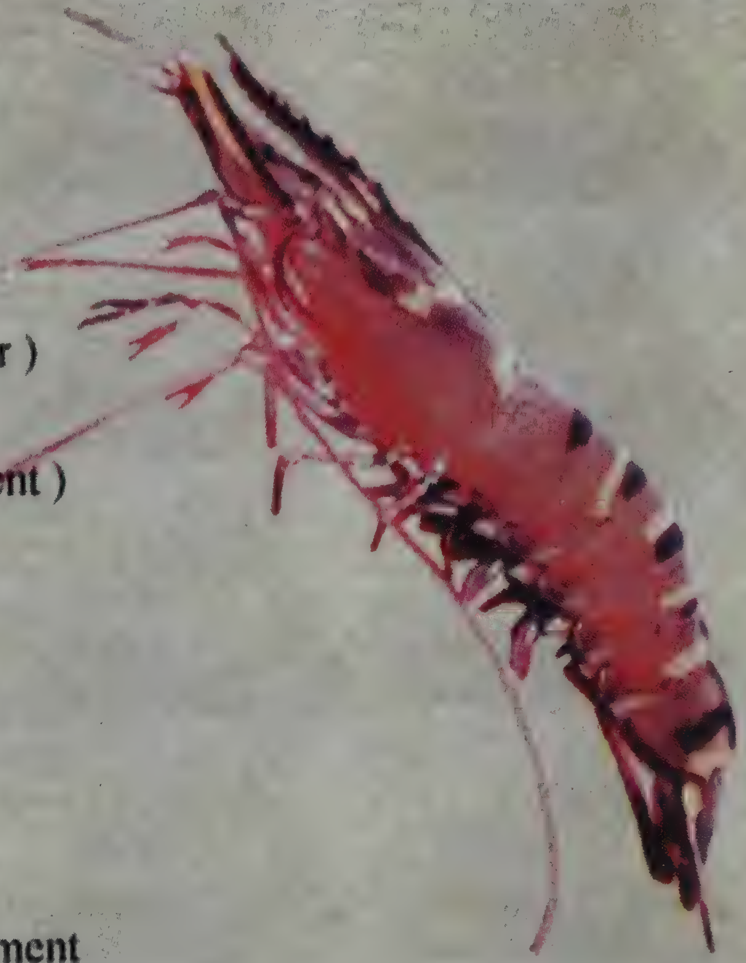

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Third Asia - Pacific Fishing/Ausmarine East Conference

Cairns,Australia,3 and 4 July 2001

The captioned conference with an exhibition as its integral part was conducted on 3 and 4 July 2001 at Cairns Convention Centre, Cairns, Queensland, Australia by Baird Publications, Melbourne, Australia. Dr. Ian Cartwright, Deputy Director in Forum Fisheries Agency, elected by 16 constiuent countries was the Chairman of the Conference. Based in Honaria, Solomon Islands, Cartwright is engaged in the management and development of tuna resources of EEZs not only of the sixteen countries but also of the region as a whole.

Session 2 : L to R Mr. Mori Flapan, Ms. Anne English, Dr. Ian Cartwright, and Ms. Kaye Sauer

The conference turned out to be a major converging point for several distinguished delegates with a marine focus. They consisted of those representing seafood industries, ship builders, naval architects etc. There were top class sessional chairmen.

The Australian Fishing Industry is leading the world in terms of environmentally and economically sustainable fishery development. It also leads the world in product quality. So much so, the Australian fishing industry is the world's most profitable one in terms of returns on investment, profit in terms of both per person employed in the industry and of catch per tonne. These attributes are the result of good management by both the Australian Government and fishing Industry. Yet, the Australian industry feels that they are a long way from being perfect.

The care for detail that has led to success in the fishing industry is applied in varying ways and degrees to other parts of the marine industry of Australia which too have to their credit generally good results.

The exemplary status of Australian fishing industry has provided an inspiring background to the deliberations at the Conference.

Mr. Neil Baird, Chairman of Baird Publications, warmly welcomed the participants. After formally introducing Mr. Ian Cartwright, Chairman of the Conference to the participants, he requested him to deliver his inaugural address.

Thanking the organisers and greeting the participants, the Chairman prefaced his address with a brief mention of the phenomenal growth of Australian fishing industry over the past decade. Elaborating, he said that the total value of exploited Australian marine capture fishery had risen in value from Australian $1.1 billion to 1.6 billion in ten years and, when combined with Aquaculture production (Alone worth Australian $675 million in 1999-2000), fishery sector emerged as Australia's fourth most valuable food-based primary industry. It was pointed out that many of the innovators of the fishing industry continued to invest in more efficient vessels and they were moving into value-adding and diversification into related industries.

Cartwright had also highlighted the growth of the fishing vessel building industry as part of the Australian Boat Building Sector. An interesting aspect mentioned was the diversification accomplished by a group of well-led companies not only into sea cage culture of bluefin, but also into innovative practices of marketing in Japan. Supported by strategic investment in research, the initiatives had resulted in an expansion in the quantity and value of culture production of bluefin which had grown in value from Aus $12 to Aus $200+ million in under ten years.

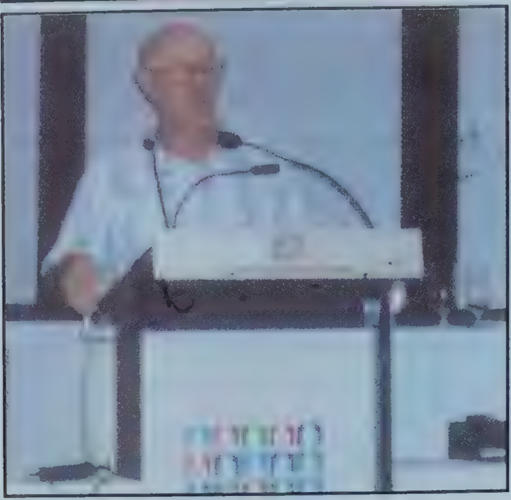
Observing that not many were able to see the true value of Australian fish

Speakers

Mr. Neil Baird, welcome address

Mr. Richard Mounsey

Mr. Ian Cartwright,Inaugaral address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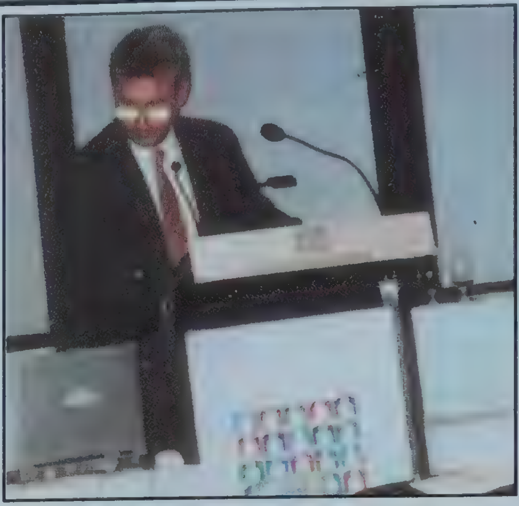
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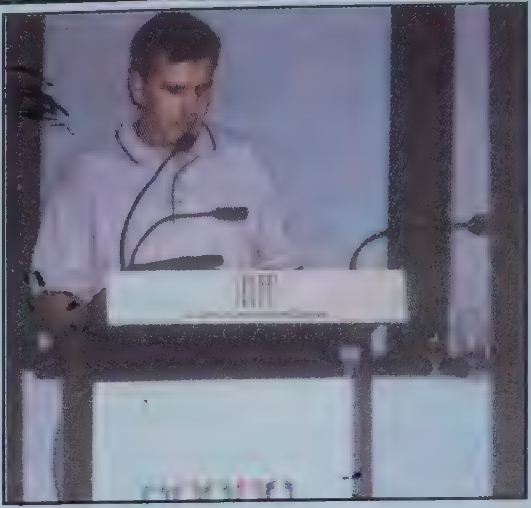
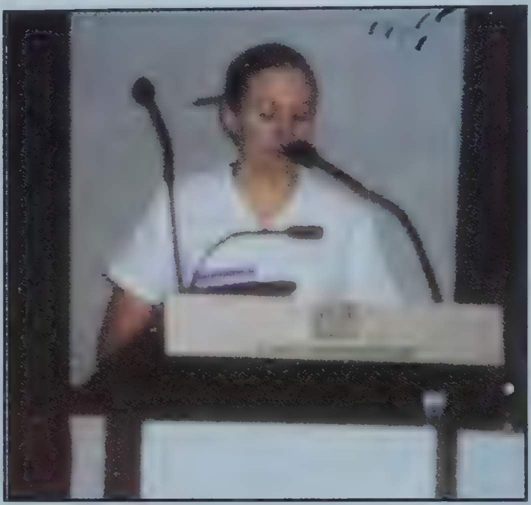

Mr. Colin Moores

Ms. P.A.J. Chintha Perera

Ms. Anne English


Ms. Justine Cleghorn

ing industry as a whole, or recognise the synergies that existed between sectors, he had complimented Neil Baird for his meticulous study of the changes that had swept Australian fisheries sector as a big wave. In this context, Cartwright said it was fitting that Neil Baird had conceived of this conference and imparted to it a solid scope that encompassed not just the strengthening of commercial fishing scenario of the country but also its entire commercial and military marine industry.

The Chairman highlighted a few significant issues. One of this related to stock assessment. It was an issue of considerable significance, considered from the angle of the exalted way in which the managers and industry as such dealt with it. For them stock assessment was the knowledge basis to assess increase of stocks and to look at the value of specific indicators such as the status and dynamics of fish populations in a revisiting perspective, particularly within the context of the precautionary approach. The result was that scientists were now able to provide the ranges within the assessment rather than single "answers". These ranges reflected the uncertainties and complexities of biological system and the fact that the more we understood the marine eco-systems the greater we realised what we did not know, particulary in terms of forecasting stock status or appropriate levels of effort or catch needed.

Cartwright also explained the important role played by Management Advisory Committees (MACs) as a major interface between industry, managers and scientists of the Australian fishing industry. The Committees were now experiencing the pleasurable rigours of interpereting and understanding the increasingly complex scientific advice being provided to guide them. It was pointed out that many fishermen nurtured the perception that any uncertainty and changes within stock assessments, represented a failure of science to come up with specific positions. He advised that industry would need to place greater reliance towards realistic stock assessment, taking heart from the scientific process of peer-review and the quality and dedication of majority of fishery scientists.

The second aspect mentioned by him was the interface between environment and fisheries at both the Federal and State levels in Australia. He emphasised the need for minimising the duplication and frustration surrounding environmental issues. It was pointed out that fishermen had been usually equal to acknowledge well presented logical positions of environmental issues. Their tendency was to ignore ill informed views on the subject. At the same time they were not lacking in their respect towards the conservation movement.

Referring to the success of the Australian fishing industry, he said that this was because of the diligence of managers and industry in applying the principles of environmentally sustainable development. He added that what was good for the resources and sustaining ecosystem was also good for profit.

Concluding his presentation, Ian Cartwright lauded the efforts of Neil Baird and his team for putting altogether a well-organised and worthwhile conference that the event would prove to be beneficial to the wider marine industry.

Technical Sessions

In Session one, chaired by Dr. Richard Mounsey, of the United Nations Transistional Administration in East Timor (Fisheries Service), environmental issues were covered. There were seven presentations. One of these was a paper on "Ensuring Sustainable Development of Fisheries through a Regional Code of Conduct for responsible Fisheries" by Bundit Chokesanguan of SEAFDEC. Bundit explained that a programme for the regionalisation of the code of conduct for responsible fisheries was approved and supported at the 30th SEAFDEC Council meeting held in March 1998. The programme was comprehensive and it satisfied the requirements of fisheries development in the region. The programme aimed at covering as much area as possible and gradually expand into other articles of the Code of Conduct. The additional advantage of the programme had been the formulation of cohesive networks of core experts in the various technical disciplines bringing about regional unity and enhancing awareness of the need for regional consolidation of efforts to achieve sustainable fisheries development and to work together to achieve success.

He said that the programme consisted of four phases: Fishing Operations, Aquaculture, promoting a cadre of Fisheries Managers and imparting efficiency to Fisheries Post-Harvest practices. All major tasks of the programmes had been implemented by the respective departments of SEAFDEC and completed successfully, he added.

Session two, with Kaye Sauer of Baird Publications as the Sessional Chairman, dealt with various regulatory and legal issues and vessel equipments. Altogether nine papers were contributed. Among the papers presented, the most impressive one was the presentation made by Collin Moores of Xantic (Asia-Pacific) of Australia on the "Fleet operator or Asset Manager-Decisions made in the information age", a subject that could be of benefit to all fishing compaines of the region. The main point made was that the fleet manager should not function just as a fleet operator alone. He would have to function in a larger context as an asset manager too. While managing the fleet might be his job, his functions went far beyond that, it was explained. He would have to manage assets such as fishing vessels too. This function was a deeper one with an enlarged and more meaningful complexion and with hues of an integrated job or function. He expanded on the subject at length explaining as to how assets were to be managed and how this would be different from just managing a fleet. He highlighted the various aspects of effective asset management such as protecting initial cost of vessels, taking proper care of returns, time/money/changes, life cycle returns, maintenance planning, accountability and the greater organisational impact for achieving ideal asset management. There had to be goals and a plan, besides commitment, good training background, matching needs to reality, scalability into future etc. It was also explained that a good asset manager would have to base his decisions on facts, and should be able to incorporate flexibility and adaptability while implementing the decisions.

Session three, devoted to fisheries and fishing equipments was chaired by Julie Robins of Southern Fisheries Centre, Queensland Department of Primary Industry, Australia. Altogether seven papers were presented at the session. One of these was a paper on "Products and solutions to cater to diverse needs of Pacific fisheries", presented by Meenakshi Goyal of Garware-wall Ropes, Pune, India, authored by herself and Pravin Gogia.

As an introduction, Meenakshi Goyal said that Garware-Wall Ropes was part of the Ramesh Garware group, a world leader par excellence in the manufacture of synthetic ropes, twines and nets. The company introduced many new products in the recent past, with a strong emphasis on quality of the products to conform to international standards. The company strove continuously to widen and improve their product range, and to ensure that each new product was a step further up in the value change, thereby keeping in line with the company's strategy of offering its customers superior products at competetive prices. It was added that the company had its production capacities spread over two modern plants located one each at Pune and Wai in western part of India. It was mentioned that net making machines were manufactured by the company in collaboration with Toyo Kogyo of Japan, world leader in fish net machine manufacture.

Garware-Wall Ropes was working towards becoming a total solution provider in the world of synthetic cordages and nettings, the speaker said. Highlighting the company's background and product facilities as well as the range of products, she related them to the dimensions of the Pacific fisheries market. It was pointed out that Australia's fisheries resources were diverse with over 70% of the global tuna production coming from the Pacific region. She said that the Australian fishing operators concentrated their efforts on estuarine, coastal, pelagic and demersal species that occured on the continental shelf. It was pointed out that the level of Australian fishing activity had increased over the last decade to the point where almost all the known major fish, crustacean and mollusc resources were fully utilised. Some major fisheries such as Southern Tuna, Gemfish and shark suffered biological depletion. Fish farming was an emerging activity for supplementing wild fisheries, in order to meet the growing global demand for seafood, it was mentioned.

Meenakshi Goyal told the participants about the product range of the company included three strand hawser laid ropes, eight strand plaited ropes, braided and twisted twines, fish nets (of PE, Nylon mono & nylon multifilament), polypropylene, multifilament yarn and twine, sports nets, rope articles and geo-products. It was mentioned that Garfil-Ultima Olivene Mk.2 Braided twine, Garfil mussel farming system, Nylon monofilament fish nets and several speciality ropes were introduced by the company in the recent past. The details of the new products were mentioned.

In respect of mussel farming system manufactured by the company, it was explained that it was a unique product made from a combination of rigid backbone and soft but strong side chains. Garfil Maxima high strength rope was used for continuous length as backbone for the system. To this strong backbone, Garfil shade nets were stitched at equal intervals and each shade net had approximately six metres of vertical height from the rope. Heavy threads were used for doing stitching of nets with rope. Galvanised steel weights were tied at the bottom of the net to provide uniform tension. The rope ends were eye-spliced for easy tying. The system could also be made as per specific requirements of the customers, she clarified.

P.A.J. Chinta Perera of National Aquatic Resources Research and Development Agency, Srilanka, presented a paper on "Kraal Trap Fishing in the Bolgoda Estuary, Srilanka". She had explained that Kraal was one of the traditional trap fishing methods in Srilanka and use of this type of gear was the most popular method adopted for shrimp capture in the Bolgoda eastuary. The primacy of this system had now been lost because of man-made interventions such as pollution, destruction of mangroves and practising of harmful fishing methods. Shrimp catches from Krawls had now come down considerably.

Two papers, one on "Fishing opportunities in the Indian Ocean Rim" authored by Wicharn Sirichai Ekawat of Sirichai fisheries, Thailand and another paper entitled "Focal Tuna fishing initiatives in Indian EEZ" by J.V.H. Dixitulu of *Fishing Chimes*, India, were presented.

Sirichai said that, even though the countries around the Indian Ocean rim had developed their commercial fisheries significantly over the last 20 years and the fisheries resources were also exploited by the distant water fishing fleets of the countries, there were still many great opportunities for the fishing industry in this area. Utilising and developing the Indian Ocean was still open to both local and overseas fishermen, but it was important for any potential investors to examine the commercial viability of any of the ventures and take into account the increasing level of regulations and the imperative of fishing in a responsible manner, he said.

Pointing out that, out of a total fishery resource potential of 3.934 million tonnes, the average level of annual exploited fishery in the Indian Exclusive Economic Zone (EEZ) was 2.46 million tonnes, Dixitulu highlighted in his paper that, in the Indian EEZ a) demersal resources upto the shelf zone were optimally exploited/overfished; b) pelagic resources of the shelf zone stood exploited to the extent of 75 per cent of the potential (1,222,000 tones); c) out of the balance of 452,600 tonnes of pelagic resources available in the shelf zone, 180,600 tonnes of tuna with a predominant component of yellowfin were available for exploitation; and d) an additional tuna resource of the order of 200,000 tonnes was probably available for exploitation in the oceanic zone.

Indicating that future fishing opportunities in the Indian EEZ were poised largely in the direction of exploitation of its tuna resources, the paper endeavoured to bring out the focal initiatives taken for their exploitation, while also presenting the background and the supporting action needed to strengthen the initiatives.

The other paper of considerable interest presented was on "Fish Jigging machines - smart ways to hook fish", by Terry Gorman of Terry Gorman and Associates. Richard Mounsey of United Nations Transitional Administration in East Timor, read a paper on "East Timor - from Ashes to Catches". This paper narrated the turmoil through which East Timor passed to recoil back to a fish catching status. He said that the island's coastal fleet along with fishing onshore infrastructure was burnt to the ground in September 1999. The Government and Non-Government organisations had managed to significantly advance rehabilitation and development measures for the nestoration of the sector from a near-total destructive state. As a result, the number of canoes had increased from around 500 to over 1250 and the number of active fishermen had increased from about 700 to approximately 3000. However, illegal fishing, the uncertainty of marine boundaries and future management were still thorns in the flesh of the new administration.

Russ Neal of the Australian Seafood Industry Council presented a paper entitled "Australian seafood - a growing industry". He said that the value of Australian seafood production continued to raise, reaching new record levels in 1999 - 2000 and ranked as one of the fast growing commodities of Australia. The paper had explained a number of recent initiatives taken and also the new direction given to industry.

A paper was contributed on 'Economic Management for the Development of Deepsea Fishing in Indian EEZ' by C.P. Verghese, Director of Central Institute of Fisheries Nautical and Engineering Training, Cochin, India.

He had pointed out that fishing pressure in the inshore fishing grounds around the Indian coasts had been increasing year after year. At the same time fishery resources in the deep sea (beyond 100 fathoms) within the economic zone of India were not exploited to the required level. Although several reasons were attributed for not exploiting the deepsea resources to the required level, many of them did not seem to him as valid. However, he had pointed out that the most important valid reason for not undertaking deepsea fishing in the Indian EEZ, as it seemed to him, was the low value nature of unconventional fish in the deep waters of the EEZ, coupled with the exhorbitant operational cost for a fishing vessel to sail to the continental edge and slope of the EEZ which made the venture uneconomic. These aspects were discussed and suggestions were made regarding economic management for the development of the deep sea fishing in the Indian EEZ.

Session four was devoted to work boats. It was chaired by Andrew Jeffs, Editor of the Australian Journals, *Professor Fisherman* and *Fishing Boat World*. Four papers were presented.

One of these was by Neil Trainor who presented a paper entitled 'The Wheelhouse Office-Value adding through vessel monitoring systems'. The paper was authored by himself and cameron Baker. It was pointed out Queensland's commercial fishers were adopting e-commerce facilities for their day-to-day business following the first release of the Electronic Catch and Effort Reporting System (ECERS) by the Queensland Fisheries service (QFS) in February 2001.

Recognising the potential benefits in harnessing Vessel Monitoring System's (VMS) position reporting capabilities with secure and reliable two-way data communications, the QFS, in consultation

SOME OF THE STALLS

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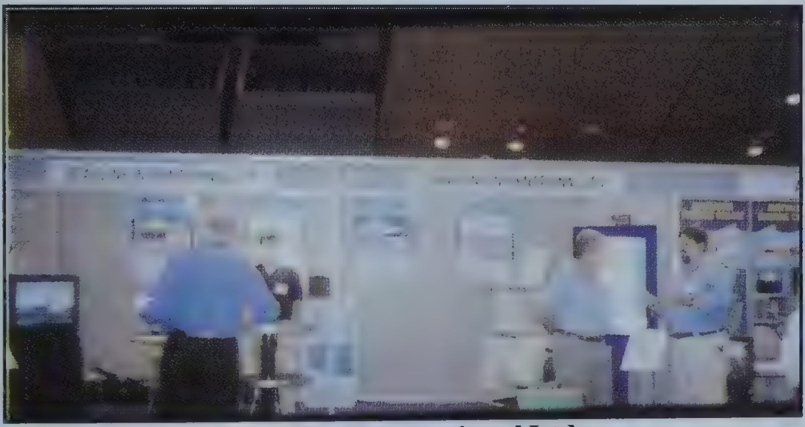

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and exhibition. He expressed confidence with industry commenced development of ECERS in 1998 to major Queensland fisheries, he clarified.

It was explained that ECERS provided on intuitive windows-based environment, which unlike on-line existing web-based shopping applications that used the internet, was designed for the e-mail based environment and used small amounts of data ideal for satellite communications. The combination of VMS/ECERS was already providing efficiency gains and cost savings to both industry and government, opportunities for adopting innovative management arrangements and the core building block for developing a economically viable commerce environment to assist fishers to maximise their value and competitivenness.

At the closing session, the deliberations that took place at the various sessions of the conference were succinctly summarised by the conference chairman, Ian Cartwright.

There was a Farewell Dinner on 4th July 2001 hosted by Baird Publications at which all the delegates and stall owners were guests. The chief guest was Dr.Robert Mounsey. Mr. Neil Baird welcomed the chief guest and all the other guests. Mounsey spoke in glowing terms about the success of the conference and thanked Mr. Neil Baird and his team from Baird Publications for the outstanding manner in which the conference and the exhibition were organised and the excellent impact the various presentations and displays at the stalls in the exhibition made on the delegates. In his farewell address Neil Baird was profuse in the articulation of his thanks to the participants, to his team and also to the management of Cairns Convention Centre. He expressed the ardent hope that the various presentations made by the speakers would be helpful in the formulation of policies and strategies for channelising fisheries development of the region in a sustainable and environment-friendly manner.

EXHIBITION

The Exhibition was held as part of the Conference on both the days. There was a steady stream of visitors who evinced keen interest to acquaint themselves with the various exhibits at the stalls which were all strikingly impressive. Those in charge of stalls were seen explaining the their products in an impressive way to the visitors.

There were altogether 56 stalls. Apart from the stall of Baird Publications, it was seen that several of the visitors gravitated towards the stalls of Australian Ship Builders Association, Cummins energy company, Energy power system (Caterpiller Engines), Garware-Wall Ropes of India, Mustad and Sons AS, Norway, Tenix Ship Building W.A., Xantic, Twin Disc, Wedderburn Scales, Electrotech, Centro Corporation, Jotun, MTU Australia, JayPac Cartons etc.

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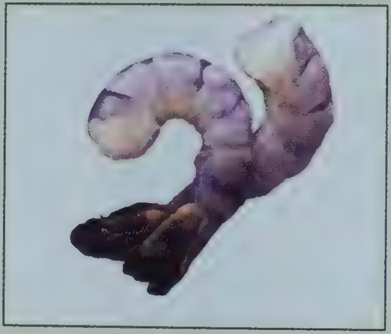

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Vibriosis in Shrimp Under Culture in Andhra Pradesh

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M. Chandrasekhar
S.V. University
Tirupathi, A.P.

Andhra Pradesh has a long coastline of 978 km and shrimp culture is mostly restricted to the land along the coastline. Andhra Pradesh is a leader among various states practising shrimp culture. Cultured shrimp produced in in A.P. accounts for 50% of total culture shrimp production of India. Of the total potential cultivable area (1,50,000 ha) available, 71,000 ha have been brought under shrimp culture. In Andhra Pradesh modifed extensive and semi-intensive culture systems are prevalent.

Shrimp culture started in early 1980s as a traditional farming system and it attained eventually an industrial status with large scale private sector participation. One jarring development, in 1994, was that shrimp culture almost collapsed due to persistent disease problem and later suffered because of restrictions imposed by supreme court in 1996. Although the industry regained its original stature due to revival of culture, diseases like white spot and vibriosis continue to devastate large areas of shrimp farms in A.P. Vibriosis is one of the major diseases that has become a critical factor deciding the fate of shrimp culture in some areas. In recent years, the pathogenicity, virulence and losses due to vibrosis have increased enormously.

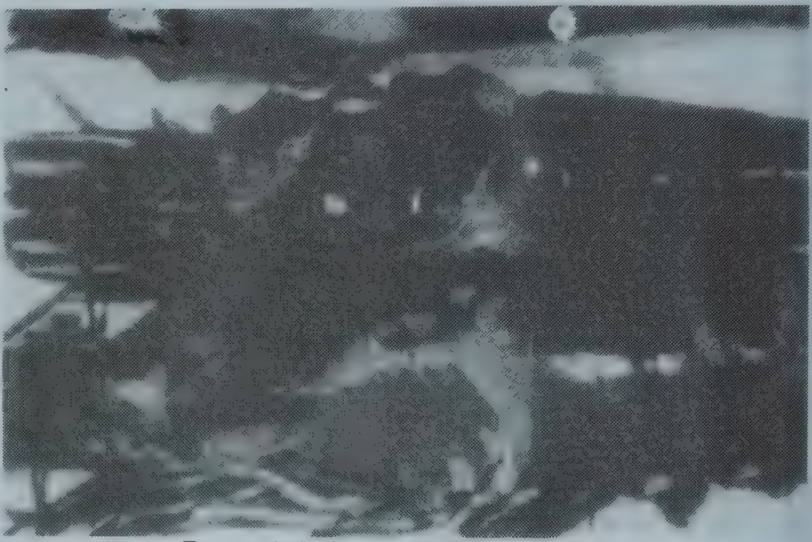
The main reasons attributed for the outbreak of vibriosis are :

1. Stocking of poor quality seed with low disease resistance.
2. High stocking densities with poor water management practices.
3. Irregular application of chemicals and fertilizers by ignorant small scale farmers.
4. Intake of contaminated water into the culture systems due to inadequate water sources; and
5. Poor pond design with structural defects, insufficient time for pond preparation.

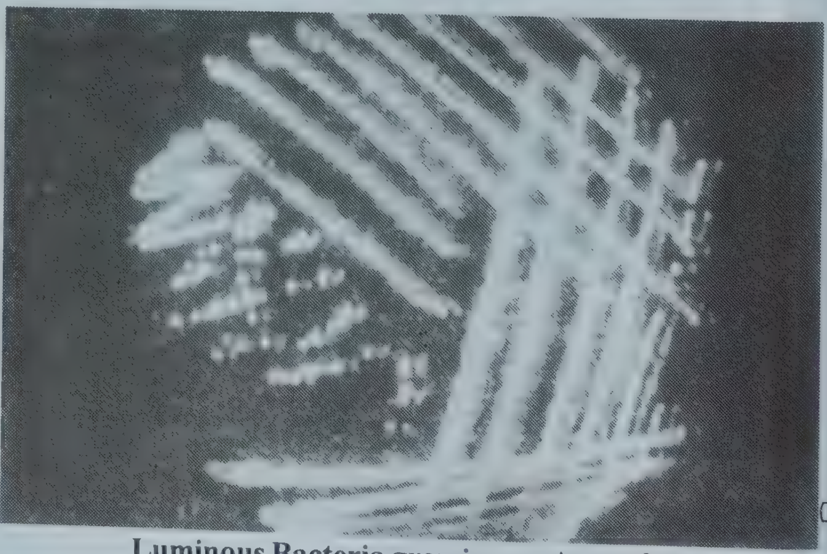
India is a country with a large number of aspiring marginal and small scale farmers. For want of adequate financial resources, most of them compromise with the available resources. However, there is an urgent need to adopt suitable management practices from the available resources to keep this menace under check and thereby save many farms from incurring huge losses.

Symptoms

1. Diseased shrimps turn opaque with a reddish/black discolouration due to the excess pigmentation of exoskeleton;
2. Tail and antennal crimps with a dorsal flexure at the third abdominal segment are commonly seen;
3. Haemolymph becomes turbid with less number of haemocytes, taking more time to clot;
4. Hepatopancreas turns reddish and swollen with the accumulation of fat and goes out of its normal functioning. As a result feed intake drastically coes down followed by mortality on a large scale; and


Bacterial disease in Tiger prawns

Tail rot Symptoms


Luminous Bacteria growing on Agar plate

Vibrio Cells in Gut

Tiger shrimp infected with Bacterial Scepticemia

Bacterial Red Disease in Tiger shrimp

5. Large no of swarming baceria are noticed in haemocoel.

Typical behaviour of affected shrimp

1. Affected shrimps appear weak and lethargic at the edges of pond without any escape reflex;
2. Feeding activity drops suddenly and healthy shrimps appear to cannibalize on weak and moribund individuals which hasten the outbreak of disease;
3. Mortality starts first with one animal and progresses to hundreds till the whole crop dies in a very short span of time; and
4. Sometimes disease may appear without any external symptoms, followed by mortality on a large scale.

Diagnosis

Proper diagnosis attains utmost significance in vibriosis because complete control is not possible without this. Field level diagnosis can be done by farmers themselves by the adoption of practices like external observation of shrimps for disease symptoms, sample netting, feed checking etc., so that suitable preventive measures can be taken at the earliest possible time. Presence of vibriosis can be detected by microscopic examination of gut and hepatopancreas in wet mounting. Vibrios can be easily isolated from the suspected samples by incubating in selective media like Tryptic soya Agar, Blood agar, Standard method agar at 37°C for 24 - 48 hrs.

Various species of pathogenic vibrois and their typical colony appearance is given in the following table:

Vibrio species	**Colony appearance**
V.splendidus	Green luminous
V.fisheri	Medium size green (90%) or yellow
V.algindyticus	Large yellow
V.vulnificus	Large green (90%)
V.cholerae	Large yellow
V.mimicus	Large green
V.damsella	Medium green(95%) or yellow
V.anguillarum	Small yellow

A series of biochemical tests like oxidase test, sugar fermentation test, kangawa test, salinity tolerance test and glycerol test can be used for species level identification of pathogenic vibrios.

Preventive Measures

Vibriosis is a typical bacterial disease of cultured shrimps often found to cause mass mortalities. These may occur due to luminous bacterial disease, one month mortality syndrome and due to the normal bacterial septicemia pathogens which form regular part of microflora in the pond ecosystem.

These bacteria infect shrimp under stressful environmental conditions when the animal is vulnerable to pathogenic bacterial infection. So the incidence of this disease can be prevented by painstaking adoption of preventive measures, particularly in regular farming systems.

Numerous strategies have been adopted to control the outbreak of vibriosis in penaeid shrimp farming. These range from application of improved management practices to stocking specific pathogen free stock.

1) Sludge left in the pond bottom contains high load of organic matter, toxic compounds and bacteria which are harmful for shrimps. So care should be taken that these pernicious substances are removed thoroughly so that shrimps do not suffer during next culture cycle. Immediately after harvest, pond bottom should be allowed to dry by exposure to sunlight till cracks are

☞

formed. One effective pond preparation method involves the use of burnt lime @ 100 ppm before water intake into the pond.

2) The problem with vibriosis and motile aenomonads in tropical countries can be better addressed by the production of good quality PL. Studies indicate that PL are infected with vibrios in the hatchery itself and their release into culture systems detonates an epidemic of vibrosis. Such PLs are mainly responsible for the outbreak of devastating diseases lie LB and one month mortality syndrome, in some areas. To prevent this, PLs should be carefully screened by routine microbiological and seed testing in laboratories before stocking.

3) The water in grow-out ponds must be pretreated to kill the micro-organisms and their carriers before stocking. Spread of vibriosis from neighbouring farms by horizontal transmission can be prevented by the use of reservoirs and regular water treatment procedures before PLs are let into the pond.

4) It is not enough to stock disease free seed. It is simultaneously important to maintain hygienic conditions in the entire pond bottom and maintain sufficient water depth in order to avoid fluctuations in temperatures and thereby protecting shrimps from environmental stress.

5) Field investigations revealed that the incidence and severity of vibrios was lower when shrimps were raised in lower salinities. In lower salinties vibriosis does not spread as fast as in higher salinities, because some of the harmful vibrio species like *V.parahemolytius* and *V.anguillarum* need salinity for their survival. Lowering pond water salinity serves as an effective measure against LB disease and one month mortality syndrome.

6) Latest trend in shrimp culture is to incorporate beneficial live microbes mostly in the form of aqua probiotics into the culture systems. Anaerobic degenerating bacteria supplanted in the form of aqua probiotics not only purify dead decaying organic matter but also multiply rapidly suppressing the growth of pathogen bacteria by competitive inhibition. Gut probiotics incorporated into the feed may help to reduce gut pH, where pathogenic bacteria like vibrios do not thrive well. Further, these facultative bacteria improve food quality. Feed utilization enhances host defence mechanism and promotes growth.

Antimicrobial agent	*Use*
Lactans Amoxycillin	Not effective against vibrios.
Nitrofurans Furazolidone Nifurpirinol	Antibacterial and antiprotozoal.
Phenicols Chloramphenicol Thiamphenicol Floramphenicol	Broad spectrum antibiotics but banned in USA and other European countries.
4 - Quindones Nalidixic aid Fluamequines Enroflaxin	Broad spectrum antibiotic affective against gram- ve vibrios.
Rifampicin	Controls luminous vibrios.
Sulphanamides Trimethoprim Ormethoprim Co-trimethazide	Vibrio.
Tetracyclines Oxytetracyclines Dioxycyclines Chlorotetracyclines	Presently it is out of normal usage as vibrios and aeromonads become resistant

7) Shrimps lack specific defence system with almost no immunological memory but have well developed non-specific defence mechanism. Hence any enhancement in its defences against pathogen can only be for a short span of time. Immunostimulants like peptiodoglycans /levamisole incorporated into the feed may help in enhancing shrimp disease resistance. In addition, nutritional supplements like vitamin - C boost shrimp immune system.

Control

Vibriosis can be controlled in its early stage of infection when the typical symptoms of disease are not apparent outwards. Treatment methods like resorting to sanitizer application, inducing shrimp to moult thereby reducing regular pathogenic vibrio load and supplementation of antibiotics in feeds may prove to be effective before mortality starts. But once mortality starts when the disease is in its final stages of infection, it is very difficult to control the disease. In such cases, application of a broad spectrum of powerful antibiotics like nitrofurans may prevent mortality due to vibriosis.

Some of the basic sets of antimicrobial agents routinely used and their effectiveness against spread of pathogenic vibrios is given in the table given above.

In summary, it can be said that vibriosis has been present in a latent form along the Indian coast during the past few years. A strong environmental stress has apparently been responsible for the detonation of the disease. Incidence of vibriosis is observed to be coincidental to *El Nino*. It is very important to pay attention to the possible signs of disease, instead of facing a sudden encounter with mortalities. Preventive measures like stocking of good quality seed, adopting efficient water quality management, use of probiotics in culture systems, learning to manage these diseases to minimise their impact can be the difference between success and failure of shrimp aquaculture business.

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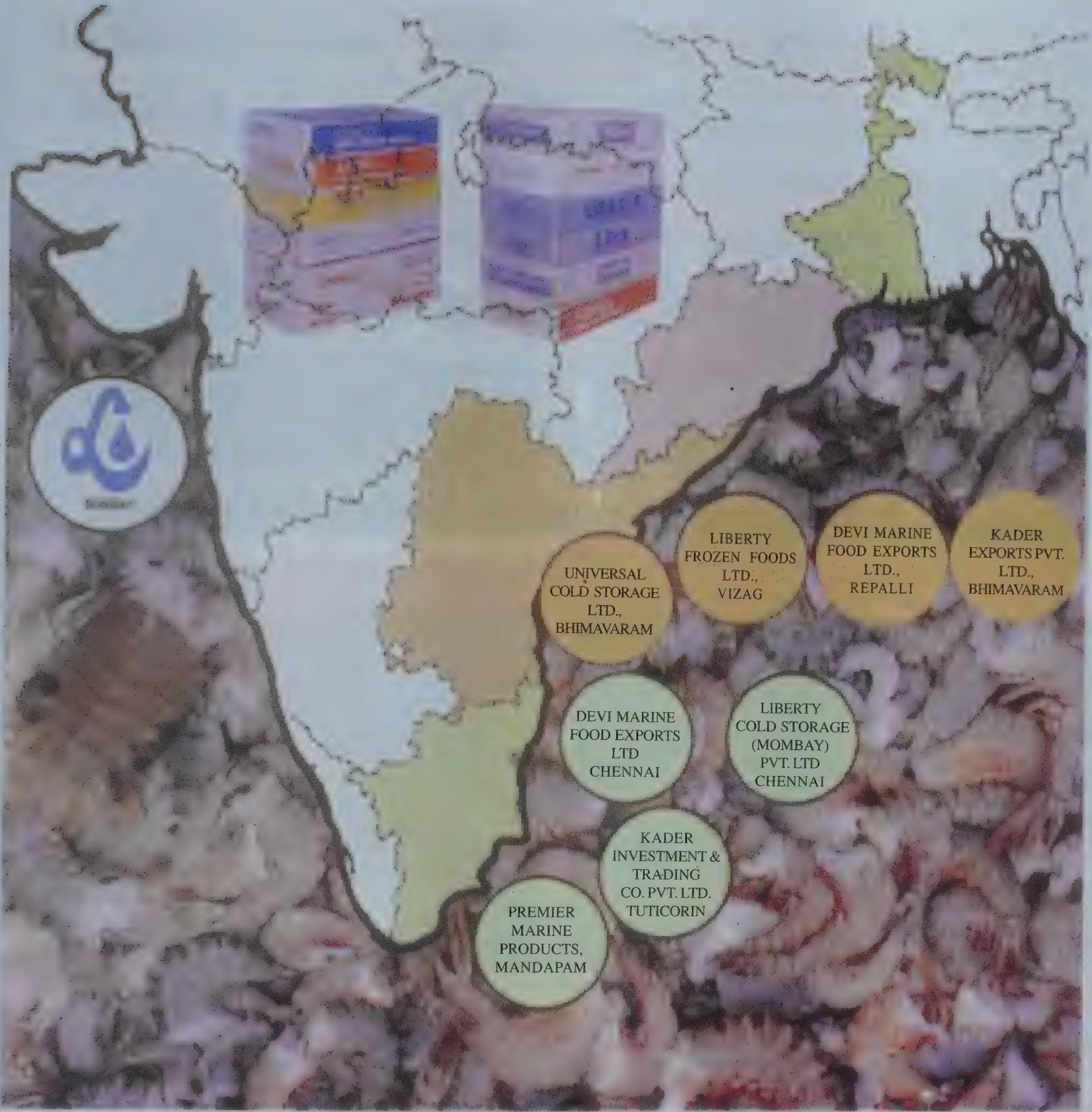
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Ammonia Excretion in *Penaeus monodon* Postlarvae during Handling and Transfer

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In this paper ammonia excretion rate was used as an index of the physiological state of ***Penaeus monodon*** *postlarvae (PL) by monitoring excretion rates after handling and transfer to physiologically different media. The ammonia excretion rate of postlarval* ***P. monodon*** *increased from a mean of 0.543 μg to 0.815 μg total NH_3-N per mg dry weight per hour after transfer from 32 to 20 ppt sea water. PL transferred to 40 ppt showed a significant decrease in excretion rate to 0.423 μg total NH_3-N per mg dry wt per hour. These changes in excretion rate after transfer to different salinities were only temporary since acclimatized PL showed only minor deviations in excretion rate from the control. PL transferred from normal (8.2) to low (7.2) pH had elevated ammonia excretion rates, from 0.591 μg to 0.733 μg total NH_3-N per mg dry wt per hour, while those transferred to high pH (9.2) had excretion rates that dropped drastically to 0.259 μg.*

About 40% of the PL in high pH were moribund after the 150 min exposure. The ammonia excretion rate of PL after a 1 hour feeding was twice that of unfed PL during the first 15 minutes after transfer. This difference narrowed with time and was no longer significant at 75 minutes after transfer which was also the duration that represented the postprandial surge in ammonia excretion after the 1 hour feeding.

The present practice in most prawn hatcheries in the Philippines involves handling and transfer of early postlarvae during the thinning-out process or of late postlarvae during harvest and stocking in ponds. Mortalities that result from these transfers are apparently low, although exact figures are not available due to the difficulty in making accurate estimates of postlarval populations during and after transfer.

The ammonia excretion rate has been used as an index to assess the physiological state of aquatic organisms as they adapt to their environment. In crustaceans, ammonia excretion has been studied in relation to osmotic regulation (Haberfield *et al.*, 1975; Mangum *et al.*, 1976; Spaargaren *et al.*, 1982; Regnault, 1984; Quarmby, 1985), to the moulting cycle (Regnault, 1979; Stern and Cohen, 1982) and to feeding and bioenergetics (Nelson *et al.*, 1977; Capuzzo and Lancaster, 1979; Nelson *et al.*, 1979; Nelson and Kropp, 1985). Ammonia excretion is also an important parameter in the study of acid-base regulation of aquatic animals (Kormanik and Cameron, 1981a).

This study evaluated the physiological state of *Penaeus monodon* postlarvae after handling and transfer to media of low or high salinity or pH using the ammonia excretion rate as an index. The effects of acclimatization to low or high salinity, of feeding and of the absence of handling stress on the level of ammonia excretion were also examined.

Materials and Methods

Experimental animals: Hatchery produced *P. monodon* postlarvae (17 to 22 days after moulting from mysis to postlarval stage or PL 17 to PL 22) were used in the experiments. A day before the start of each experiment, a specific number of actively feeding postlarvae of similar size were transferred to a one lit PVC cylinder having a false bottom of 400 μ mesh net. This cylinder was immersed in a 4 lit beaker containing two liters of aerated sand-filtered and cartridge-filtered (30 μm) sea water.

***Experimental protocol*:** Before the start of the transfer experiments the water in the beaker was renewed and a dense suspension of newly hatched Artemia nauplii was added (final density: 5-7 nauplii/ml). After 1 hour of feeding, the PL were distributed into 30 ml glass vials, partly immersed in a 27-28°C water bath. Each vial was stocked with two PL. Transfer of the PL was done by lifting the PVC cylinder clear out of the water and picking up each PL from the net bottom with blunt metal forceps. The lifting of the PVC cylinder was done to simulate the hatchery practice of netting PL from the harvesting box and transferring them to a receiving pail or basin. All transfer experiments were started at 10:00 hrs. Duplicate one ml samples of water were taken from the vials before transfer and at 15 min intervals thereafter. At the end of each experiment, the PL were dried at 70°C for 24 hours and weighed in a Cahn microbalance.

***Effect of transfer to new salinity on ammonia flux*:** Six vials contained 25 ml of 20 ppt sea water, another six of 32 ppt (control) and another six of 40 ppt. Salinity was altered using either distilled water or brine.

***Effect of pH on ammonia flux*:** The salinity was the same in all 18 vials; the vials were divided into three groups, containing sea water with a pH of either 7.2, 8.2 (control) or 9.2. The pH was altered by adding either 1N HCL or 1N NaOH solutions.

***Effect of salinity acclimatization on ammonia flux*:** In the salinity acclimatization experiment, three groups of PL were allowed to acclimatize to either 20,32 or 40 ppt sea water in 4 lit glass jars for 72 hours. During the first 54 hours the PL were fed newly hatched *Artemia* nauplii.

transfer stress. The regression line of the fed group also had this stress component aside from the feeding component. Sevently-five minutes after transfer, when the points of both lines were no longer significantly different, can be considered the time when the post-prandial increase in ammonia excretion ends. Jones and Kurnaly (1987) reported a gut clearance time of 1 hour for *P. monodon* PL (PL1). It would be logical to expect a lag time for ammonia excretion to subside after the gut is empty.

Difference in the rates of ammonia excretion between control groups of the different expereiments may in part be due to size differences. It is also possible that within a certain group, PL from different broods may differ in their efficiency in utilizing *Artemia* as prey. In the last experiment, ammonia excretion rates of the supposedly fed group did not deviate to any degree from the unfed group. This may mean that PL confined in small glass vessels without a netting substrate to grasp will not eat, even after a 24 hour acclimation. This experiment also shows that both groups had slightly elevated ammonia excretion rates right after water change despite the absence of handling stress.

Acknowledgements

Thanks are due to Mr. Aurelio Alibo, Mr. Federico Ledesma, Mr. Esteban Garibay and Ms. Magdalena Degilla.

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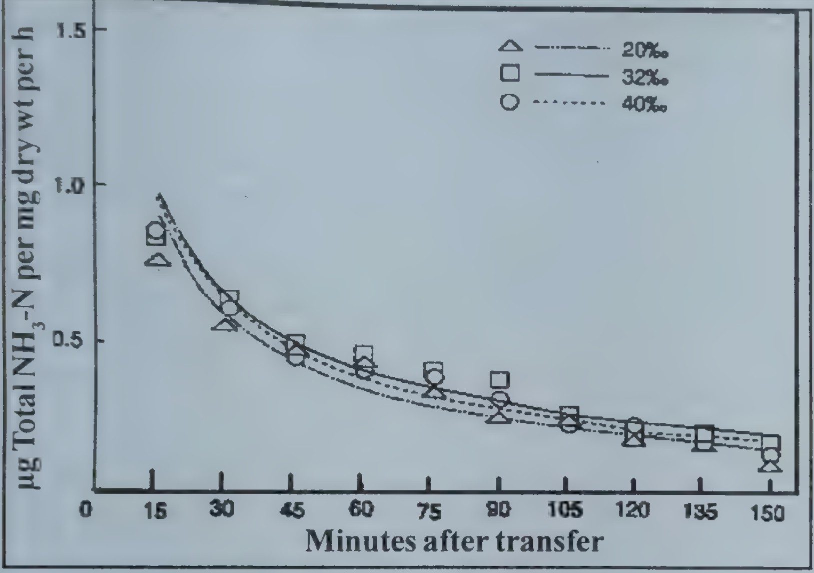

Fig 2. Ammonia excretion rates of *Penaeus monodon* postlarvae acclimatized for 72 hrs to 20, 32 or 40 ppt and then transferred to the salinities to which they were acclimatized

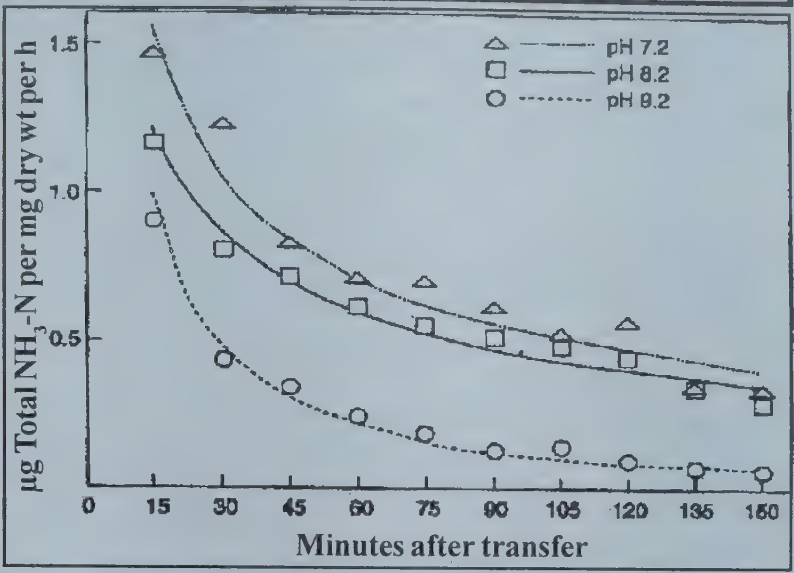

Fig 3. Ammonia excretion rates of *Penaeus monodon* postlarvae after transfer from sea water or pH 8.2 to sea water pH 7.2, 8.2 or 9.2.

($P<0.01$). Ammonia efflux of the fed group was twice as high ($P<0.01$) as the unfed 15 min after transfer. This difference narrowed with time and at 75 min after transfer was no longer significant ($P>0.10$).

Ammonia flux in the absence of handling stress : The regression lines of unfed and supposedly fed groups not exposed to handling stress were not significantly different ($P>0.25$) from each other. Both lines were significantly different ($P<0.05$) in slope from the fed groups. However, both lines were not significantly different in slope ($P<0.024$) from that of the unfed group in the feeding experiment.

Discussion

The elevated rate of ammonia excretion in *P. monodon* postlarvae transferred to low salinity is consistent with the observations reported for other crustaceans (Spaargaren, 1974; Habeerfield *et al.*, 1975; Mangum *et al.*, 1976; Spaargaren *et al.*, 1982). Euryhaline crustaceans are known to adapt to changes in external osmotic concentrations by altering the free amino acid (FAA) content of their tissues as the inorganic ion content and osmolality of the haemolymph are being modified. Haberfield *et al.* (1975) working on *Carcinus maenas* and Mangum *et al.* (1976) on *Callinectes sapidus* reported increased rates of ammonia excretion after transfer of these crabs to diluted media, during periods when tissue FAA were declining. Emerson (1969) attributed this increase in ammonia excretion to increased catabolism of amino-acids through elevated activity of 3-glycerophosphate dehydrogenase.

Far less attention has been given to the effect of transfers to higher salinities on crustacean nitrogen metabolism. In this study, it is shown that indeed an opposite reaction happens during exposure to high salinity as shown by the significant decrease in ammonia excretion in postlarvae transferred to high salinity (Fig. 1).

The change in the rate of ammonia excretion after transfer of *P. monodon* PL to low or high salinity does not reflect a permanent effect of the new salinity. It could simply represent the initial adjustment phase during salinity acclimatization. This is shown in Fig. 2, where PL acclimatized for 3 days to high or low salinity did not have a significantly different excretion rate from PL in the normal sea water control. This is at variance with the observations of Spaargaren *et al.*, (1982). They reported a higher ammonia excretion rate in *P. japonicus* at steady state conditions in lower salinities.

Results of the pH experiments may elucidate the relative roles of un-ionized ammonia (NH_3) and ionized ammonia (NH_4^+) in the excretion of ammonia of this species. Although there are numerous sources of uncertainty in estimating ammonia gradients between the organism and the environment, at low environmental pH most of the ammonia is in the form of NH_4^+, making the environment a sink for NH_3. At higher environmental pH the gradient for NH_3 is reversed, that is from the environment to the organism. Ammonia excretion in *P. monodon* postlarvae increased at low pH and decreased at high pH indicating that gradients for NH_3 may exert a greater influence than for NH_4^+ in determining the direction and magnitude of ammonia flux. This is consistent with the observations of Kormanik and Cameron (1981b) on the ammonia excretion of the blue crab.

High environmental pH appears to be more lethal to PL than low environmental pH. This was shown by the 40% moribund PL at the end of the 150 min exposure to high pH. This reaction may be partly explained by the internal accumulation of NH_3 at high environmental pH (Wright and Wood, 1985). Thus in the light of these observations it is not advisable to stock PL into ponds with elevated pH or into ponds that have recently been limed.

The levels of ammonia excretion in fed and unfed PL show that even the unfed PL had an initial increase in excretion rate which was due to handling and ☞

transfer stress. The regression line of the fed group also had this stress component aside from the feeding component. Seventy-five minutes after transfer, when the points of both lines were no longer significantly different, can be considered the time when the post-prandial increase in ammonia excretion ends. Jones and Kurnaly (1987) reported a gut clearance time of 1 hour for *P. monodon* PL (PL1). It would be logical to expect a lag time for ammonia excretion to subside after the gut is empty.

Difference in the rates of ammonia excretion between control groups of the different expereiments may in part be due to size differences. It is also possible that within a certain group, PL from different broods may differ in their efficiency in utilizing *Artemia* as prey. In the last experiment, ammonia excretion rates of the supposedly fed group did not deviate to any degree from the unfed group. This may mean that PL confined in small glass vessels without a netting substrate to grasp will not eat, even after a 24 hour acclimation. This experiment also shows that both groups had slightly elevated ammonia excretion rates right after water change despite the absence of handling stress.

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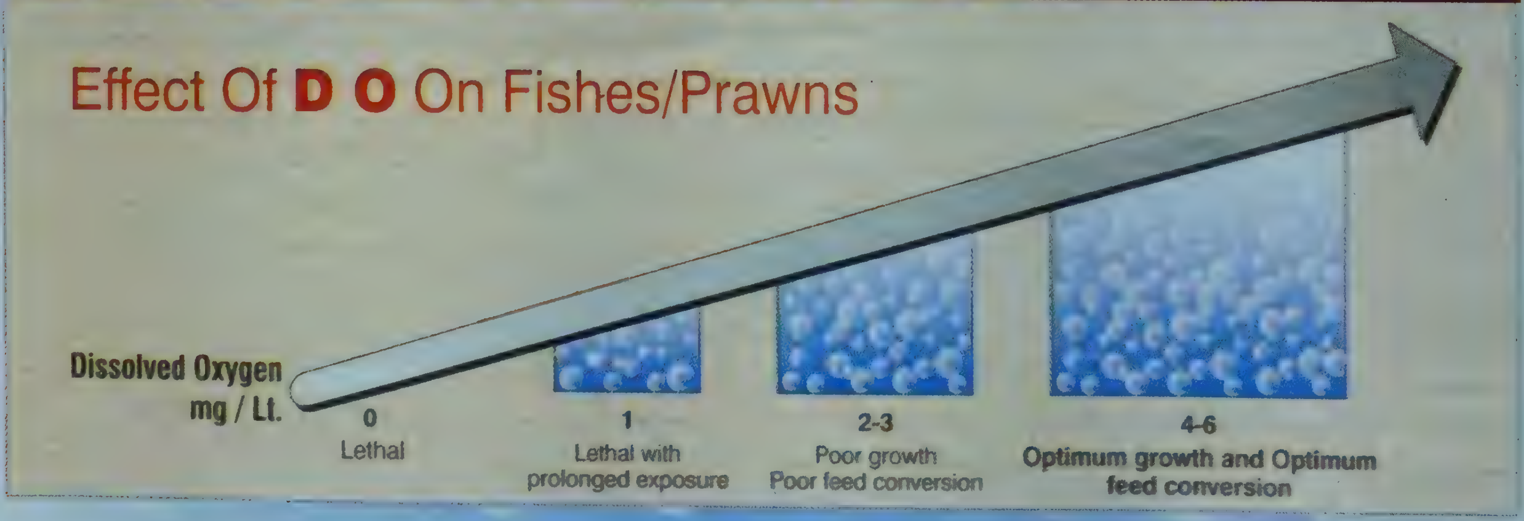

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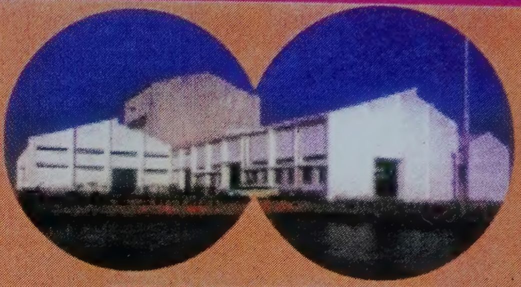

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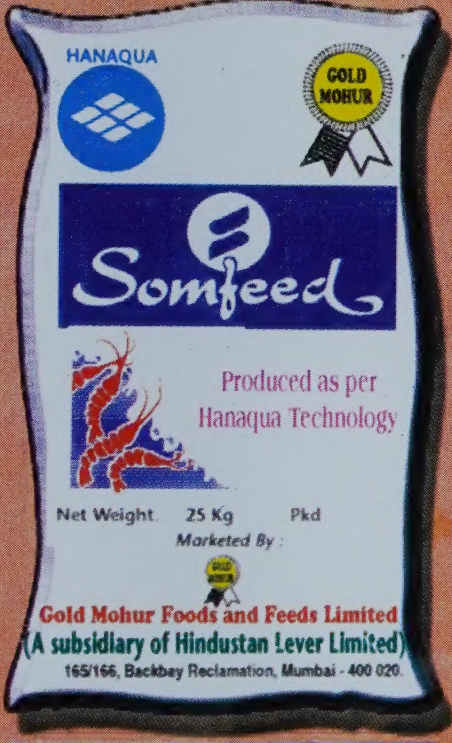
For Semi- Intensive Culture


HANAQUA
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Produced as per Hanaqua Technology
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For Extensive Culture

Product Features :

- Scientifically formulated for balanced & complete nutrition.
- Rapid growth and faster weight gain of Shrimps.
- Excellent water stability, attractability and palatability.
- Manufactured in 100% imported plant as per Hanaqua Technology.

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GOLD MOHUR FOODS AND FEEDS LIMITED
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